Bureau of Resource Protection - Wetlands

Form 3 – Notice of Intent
Massachusetts Wetlands Protection Act (M.G.L. c.131 s.40)

Moraga Storage LLC
358 Coldbrook Road
Oakham, MA

Submitted to:
Oakham Conservation Commission
2 Coldbrook Road
Unit 7
Oakham, MA 01068

MassDEP Central Regional Office
8 New Bond Street
Worcester, MA 01606

Prepared for:
Moraga Storage LLC
800 N. King Street, Suite 304
Wilmington, DE 19801

Prepared by:
Epsilon Associates, Inc.
3 Mill & Main Place, Suite 250
Maynard, MA 01754

May 12, 2026

Epsilon ASSOCIATES INC.

6970-NOI

May 12, 2026

Oakham Conservation Commission
Town Hall
2 Coldbrook Road, Unit 7
Oakham, MA 01068

Subject: NOTICE OF INTENT: Moraga Storage LLC, 358 Coldbrook Road, Oakham, MA.

Dear Commissioners:

On behalf of the applicant, Moraga Storage, LLC (the "Applicant"), Epsilon Associates, Inc. ("Epsilon") is pleased to submit this Notice of Intent ("NOI") to the Oakham Conservation Commission. The NOI was prepared in accordance with the Massachusetts Wetland Protection Act (MGL c.131 § 40) and implementing Regulations (310 CMR 10.00).

As outlined in greater detail in the NOI, the Applicant proposes to construct a 180MW Battery Energy Storage System on the above referenced property. As part of the Project, a portion of the existing gravel driveway that crosses the 100-foot Buffer Zone to Bordering Vegetated Wetlands ("BVW") will be improved and is therefore subject to the jurisdiction of the Massachusetts Wetlands Protection Act ("WPA"). This is the only aspect of the Project that is within the Commission's jurisdiction under the WPA.

Wetland resource areas on the Project Site were previously reviewed and approved by the Conservation Commission through an Order of Resource Area Delineation ("ORAD") dated December 3, 2024 (MassDEP File No. 252-0150). The Applicant is aware of comments raised by the Town of Oakham during the Energy Facilities Siting Board evidentiary hearings suggesting that the BVW boundary may differ from that approved under the Order of Resource Area Delineation ("ORAD"); however, as MassDEP noted in its April 15, 2026 email transmittal to the Commission, modification of delineated BVW boundaries within the ORAD area is not permitted prior to the ORAD's expiration in 2029.

Further, based on available field data and applicable regulatory criteria, the Applicant maintains that the area in question does not constitute a jurisdictional resource area under the WPA and is therefore not shown on the enclosed plans. Nonetheless, as a good-faith and conservative measure, the Project has been designed to avoid any alteration of this area and to comply with all applicable performance standards, and the Applicant looks forward to further discussion during the Commission's review of the NOI.

We understand that the Commission will publish the public notice in a local newspaper at least five days prior to the hearing date and that the Applicant will be billed accordingly. This NOI is being submitted for the Commission's review at the next scheduled public hearing, in accordance with the requirement that a hearing be held within 21 days of filing. If the Commission has any questions regarding this NOI, please do not hesitate to contact me directly at (978) 461-6218 or via email at ghochmuth@epsilonassociates.com.

Sincerely,
EPSILON ASSOCIATES, INC.

Greg J. Hochmuth, PWS, CWS, RS
Senior Scientist

Encl.
CC: Massachusetts Department of Environmental Protection, CERO

NOTICE OF INTENT

Massachusetts Wetlands Protection Act (M.G.L. c.131 §.40)

Moraga Storage LLC

358 Coldbrook Road
Oakham, MA

Applicant:

Moraga Storage LLC
800 N. King Street, Suite 304
Wilmington, DE 19801

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Epsilon Associates, Inc.
3 Mill and Main Place, Suite 250
Maynard, MA 01754

May 12, 2026

Epsilon
ASSOCIATES INC.

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Provided by MassDEP:

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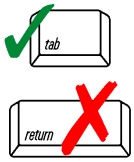
Oakham
City/Town

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



Note: Before completing this form consult your local Conservation Commission regarding any municipal bylaw or ordinance.

A. General Information

1. Project Location (**Note:** electronic filers will click on button to locate project site):

358 Coldbrook Road — a. Street Address
Oakham — b. City/Town
01068 — c. Zip Code

Latitude and Longitude:
-72.039692 — d. Latitude
42.365473 — e. Longitude

406 — f. Assessors Map/Plat Number
106.3 — g. Parcel /Lot Number

2. Applicant:

Gus — a. First Name
Hadidi — b. Last Name
Moraga Storage, LLC — c. Organization
800 N. King Street, Suite 304 — d. Street Address
Wilmington — e. City/Town
DE — f. State
19801 — g. Zip Code
401.215.4000 — h. Phone Number
i. Fax Number
ghadidi@rhynland.com — j. Email Address

3. Property owner (required if different from applicant): ☐ Check if more than one owner

a. First Name
b. Last Name
ZOVL Properties, LLC — c. Organization
5555 Anglers Avenue, Suite 27 — d. Street Address
Fort Lauderdale — e. City/Town
FL — f. State
33312 — g. Zip Code
h. Phone Number
i. Fax Number
j. Email address

4. Representative (if any):

Greg J. — a. First Name
Hochmuth — b. Last Name
Epsilon Associates, Inc. — c. Company
3 Mill & Main Place, Suite 250 — d. Street Address
Maynard — e. City/Town
MA — f. State
01754 — g. Zip Code
978.461.6218 — h. Phone Number
i. Fax Number
ghochmuth@epsilonassociates.com — j. Email address

5. Total WPA Fee Paid (from NOI Wetland Fee Transmittal Form):

$500.00 — a. Total Fee Paid
$237.50 — b. State Fee Paid
$262.50 — c. City/Town Fee Paid

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A. General Information (continued)

6. General Project Description:

To make improvements to a gravel access roadway within the 100-ft. Buffer Zone to Bordering Vegetated Wetlands ancillary to a Battery Energy Storage System facility.

7a. Project Type Checklist: (Limited Project Types see Section A. 7b.)

1. ☐ Single Family Home
2. ☐ Residential Subdivision
3. ☒ Commercial/Industrial
4. ☐ Dock/Pier
5. ☐ Utilities
6. ☐ Coastal engineering Structure
7. ☐ Agriculture (e.g., cranberries, forestry)
8. ☐ Transportation
9. ☐ Other

7b. Is any portion of the proposed activity eligible to be treated as a limited project (including Ecological Restoration Limited Project) subject to 310 CMR 10.24 (coastal) or 310 CMR 10.53 (inland)?

1. ☐ Yes ☒ No

If yes, describe which limited project applies to this project. (See 310 CMR 10.24 and 10.53 for a complete list and description of limited project types)

2. Limited Project Type

If the proposed activity is eligible to be treated as an Ecological Restoration Limited Project (310 CMR10.24(8), 310 CMR 10.53(4)), complete and attach Appendix A: Ecological Restoration Limited Project Checklist and Signed Certification.

8. Property recorded at the Registry of Deeds for:

a. County	b. Certificate # (if registered land)
Worcester Registry of Deeds	
c. Book	d. Page Number
67682	276

B. Buffer Zone & Resource Area Impacts (temporary & permanent)

1. ☒ Buffer Zone Only – Check if the project is located only in the Buffer Zone of a Bordering Vegetated Wetland, Inland Bank, or Coastal Resource Area.
2. ☐ Inland Resource Areas (see 310 CMR 10.54-10.58; if not applicable, go to Section B.3, Coastal Resource Areas).

Check all that apply below. Attach narrative and any supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

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B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

For all projects affecting other Resource Areas, please attach a narrative explaining how the resource area was delineated.

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☐ Bank	1. linear feet	2. linear feet
b. ☐ Bordering Vegetated Wetland	1. square feet	2. square feet
c. ☐ Land Under Waterbodies and Waterways	1. square feet 3. cubic yards dredged	2. square feet

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
d. ☐ Bordering Land Subject to Flooding	1. square feet	2. square feet
	3. cubic feet of flood storage lost	4. cubic feet replaced
e. ☐ Isolated Land Subject to Flooding	1. square feet	
	2. cubic feet of flood storage lost	3. cubic feet replaced
f. ☐ Riverfront Area	1. Name of Waterway (if available) - **specify coastal or inland**	

2. Width of Riverfront Area (check one):

☐ 25 ft. - Designated Densely Developed Areas only

☐ 100 ft. - New agricultural projects only

☐ 200 ft. - All other projects

3. Total area of Riverfront Area on the site of the proposed project: _____ square feet

4. Proposed alteration of the Riverfront Area:

a. total square feet _____ b. square feet within 100 ft. _____ c. square feet between 100 ft. and 200 ft. _____

5. Has an alternatives analysis been done and is it attached to this NOI? ☐ Yes ☐ No

6. Was the lot where the activity is proposed created prior to August 1, 1996? ☐ Yes ☐ No

3. ☐ Coastal Resource Areas: (See 310 CMR 10.25-10.35)

Note: for coastal riverfront areas, please complete **Section B.2.f**. above.

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B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

Check all that apply below. Attach narrative and supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

Online Users: Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☐ Designated Port Areas	Indicate size under Land Under the Ocean, below	
b. ☐ Land Under the Ocean	1. square feet 2. cubic yards dredged	
c. ☐ Barrier Beach	Indicate size under Coastal Beaches and/or Coastal Dunes below	
d. ☐ Coastal Beaches	1. square feet	2. cubic yards beach nourishment
e. ☐ Coastal Dunes	1. square feet	2. cubic yards dune nourishment

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
f. ☐ Coastal Banks	1. linear feet	
g. ☐ Rocky Intertidal Shores	1. square feet	
h. ☐ Salt Marshes	1. square feet	2. sq ft restoration, rehab., creation
i. ☐ Land Under Salt Ponds	1. square feet 2. cubic yards dredged	
j. ☐ Land Containing Shellfish	1. square feet	
k. ☐ Fish Runs	Indicate size under Coastal Banks, inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above 1. cubic yards dredged	
l. ☐ Land Subject to Coastal Storm Flowage	1. square feet	

4. ☐ Restoration/Enhancement

If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.2.b or B.3.h above, please enter the additional amount here.

a. square feet of BVW

b. square feet of Salt Marsh

5. ☐ Project Involves Stream Crossings

a. number of new stream crossings

b. number of replacement stream crossings

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C. Other Applicable Standards and Requirements

☐ This is a proposal for an Ecological Restoration Limited Project. Skip Section C and complete Appendix A: Ecological Restoration Limited Project Checklists – Required Actions (310 CMR 10.11).

Streamlined Massachusetts Endangered Species Act/Wetlands Protection Act Review

1. Is any portion of the proposed project located in **Estimated Habitat of Rare Wildlife** as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by the Natural Heritage and Endangered Species Program (NHESP)? To view habitat maps, see the *Massachusetts Natural Heritage Atlas* or go to http://maps.massgis.state.ma.us/PRI_EST_HAB/viewer.htm.

   a. ☐ Yes ☒ No

   If yes, include proof of mailing or hand delivery of NOI to:

   Natural Heritage and Endangered Species Program
   Division of Fisheries and Wildlife
   1 Rabbit Hill Road
   Westborough, MA 01581

   August 1, 2021
   b. Date of map

   If *yes*, the project is also subject to Massachusetts Endangered Species Act (MESA) review (321 CMR 10.18). To qualify for a streamlined, 30-day, MESA/Wetlands Protection Act review, please complete Section C.1.c, and include requested materials with this Notice of Intent (NOI); *OR* complete Section C.2.f, if applicable. *If MESA supplemental information is not included with the NOI, by completing Section 1 of this form, the NHESP will require a separate MESA filing which may take up to 90 days to review (unless noted exceptions in Section 2 apply, see below).*

   c. Submit Supplemental Information for Endangered Species Review*

      1. ☐ Percentage/acreage of property to be altered:

         (a) within wetland Resource Area _____ percentage/acreage

         (b) outside Resource Area _____ percentage/acreage

      2. ☐ Assessor's Map or right-of-way plan of site

2. ☐ Project plans for entire project site, including wetland resource areas and areas outside of wetlands jurisdiction, showing existing and proposed conditions, existing and proposed tree/vegetation clearing line, and clearly demarcated limits of work **

   (a) ☐ Project description (including description of impacts outside of wetland resource area & buffer zone)

   (b) ☐ Photographs representative of the site

* Some projects **not** in Estimated Habitat may be located in Priority Habitat, and require NHESP review (see https://www.mass.gov/ma-endangered-species-act-mesa-regulatory-review).
Priority Habitat includes habitat for state-listed plants and strictly upland species not protected by the Wetlands Protection Act.
** MESA projects may not be segmented (321 CMR 10.16). The applicant must disclose full development plans even if such plans are not required as part of the Notice of Intent process.

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C. Other Applicable Standards and Requirements (cont'd)

(c) ☐ MESA filing fee (fee information available at https://www.mass.gov/how-to/how-to-file-for-a-mesa-project-review).
Make check payable to "Commonwealth of Massachusetts - NHESP" and ***mail to NHESP*** at above address

*Projects altering **10 or more acres** of land, also submit:*

(d) ☐ Vegetation cover type map of site

(e) ☐ Project plans showing Priority & Estimated Habitat boundaries

(f) OR Check One of the Following

1. ☐ Project is exempt from MESA review.
Attach applicant letter indicating which MESA exemption applies. (See 321 CMR 10.14, https://www.mass.gov/service-details/exemptions-from-review-for-projectsactivities-in-priority-habitat; the NOI must still be sent to NHESP if the project is within estimated habitat pursuant to 310 CMR 10.37 and 10.59.)

2. ☐ Separate MESA review ongoing.
a. NHESP Tracking # _____ b. Date submitted to NHESP _____

3. ☐ Separate MESA review completed.
Include copy of NHESP "no Take" determination or valid Conservation & Management Permit with approved plan.

3. For coastal projects only, is any portion of the proposed project located below the mean high water line or in a fish run?

a. ☒ Not applicable – project is in inland resource area only b. ☐ Yes ☐ No

If yes, include proof of mailing, hand delivery, or electronic delivery of NOI to either:

South Shore - Bourne to Rhode Island border, and the Cape & Islands:

Division of Marine Fisheries -
Southeast Marine Fisheries Station
Attn: Environmental Reviewer
836 South Rodney French Blvd.
New Bedford, MA 02744
Email: dmf.envreview-south@mass.gov

North Shore - Plymouth to New Hampshire border:

Division of Marine Fisheries -
North Shore Office
Attn: Environmental Reviewer
30 Emerson Avenue
Gloucester, MA 01930
Email: dmf.envreview-north@mass.gov

Also if yes, the project may require a Chapter 91 license. For coastal towns in the Northeast Region, please contact MassDEP's Boston Office. For coastal towns in the Southeast Region, please contact MassDEP's Southeast Regional Office.

c. ☐ Is this an aquaculture project? d. ☐ Yes ☐ No

If yes, include a copy of the Division of Marine Fisheries Certification Letter (M.G.L. c. 130, § 57).

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C. Other Applicable Standards and Requirements (cont'd)

Online Users: Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

4. Is any portion of the proposed project within an Area of Critical Environmental Concern (ACEC)?

   a. ☐ Yes ☒ No If yes, provide name of ACEC (see instructions to WPA Form 3 or MassDEP Website for ACEC locations). **Note:** electronic filers click on Website.

   b. ACEC

5. Is any portion of the proposed project within an area designated as an Outstanding Resource Water (ORW) as designated in the Massachusetts Surface Water Quality Standards, 314 CMR 4.00?

   a. ☐ Yes ☒ No

6. Is any portion of the site subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act (M.G.L. c. 131, § 40A) or the Coastal Wetlands Restriction Act (M.G.L. c. 130, § 105)?

   a. ☐ Yes ☒ No

7. Is this project subject to provisions of the MassDEP Stormwater Management Standards?

   a. ☒ Yes. Attach a copy of the Stormwater Report as required by the Stormwater Management Standards per 310 CMR 10.05(6)(k)-(q) and check if:

      1. ☐ Applying for Low Impact Development (LID) site design credits (as described in Stormwater Management Handbook Vol. 2, Chapter 3)

      2. ☐ A portion of the site constitutes redevelopment

      3. ☒ Proprietary BMPs are included in the Stormwater Management System.

   b. ☐ No. Check why the project is exempt:

      1. ☐ Single-family house

      2. ☐ Emergency road repair

      3. ☐ Small Residential Subdivision (less than or equal to 4 single-family houses or less than or equal to 4 units in multi-family housing project) with no discharge to Critical Areas.

D. Additional Information

☐ This is a proposal for an Ecological Restoration Limited Project. Skip Section D and complete Appendix A: Ecological Restoration Notice of Intent – Minimum Required Documents (310 CMR 10.12).

Applicants must include the following with this Notice of Intent (NOI). See instructions for details.

Online Users: Attach the document transaction number (provided on your receipt page) for any of the following information you submit to the Department.

1. ☒ USGS or other map of the area (along with a narrative description, if necessary) containing sufficient information for the Conservation Commission and the Department to locate the site. (Electronic filers may omit this item.)

2. ☒ Plans identifying the location of proposed activities (including activities proposed to serve as a Bordering Vegetated Wetland [BVW] replication area or other mitigating measure) relative to the boundaries of each affected resource area.

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D. Additional Information (cont'd)

3. ☒ Identify the method for BVW and other resource area boundary delineations (MassDEP BVW Field Data Form(s), Determination of Applicability, Order of Resource Area Delineation, etc.), and attach documentation of the methodology.

4. ☐ List the titles and dates for all plans and other materials submitted with this NOI.

Moraga Storage
a. Plan Title

ARUP
b. Prepared By

Derek B. Anderson, PE
c. Signed and Stamped by

May 12, 2026
d. Final Revision Date

1" = 100' & 1" = 50'
e. Scale

f. Additional Plan or Document Title

g. Date

5. ☐ If there is more than one property owner, please attach a list of these property owners not listed on this form.

6. ☐ Attach proof of mailing for Natural Heritage and Endangered Species Program, if needed.

7. ☐ Attach proof of mailing for Massachusetts Division of Marine Fisheries, if needed.

8. ☒ Attach NOI Wetland Fee Transmittal Form

9. ☒ Attach Stormwater Report, if needed.

E. Fees

1. ☐ Fee Exempt: No filing fee shall be assessed for projects of any city, town, county, or district of the Commonwealth, federally recognized Indian tribe housing authority, municipal housing authority, or the Massachusetts Bay Transportation Authority.

Applicants must submit the following information (in addition to pages 1 and 2 of the NOI Wetland Fee Transmittal Form) to confirm fee payment:

060590
2. Municipal Check Number

5/11/2026
3. Check date

060589
4. State Check Number

5/11/2026
5. Check date

Epsilon Associates, Inc.
6. Payor name on check: First Name

7. Payor name on check: Last Name

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F. Signatures and Submittal Requirements

I hereby certify under the penalties of perjury that the foregoing Notice of Intent and accompanying plans, documents, and supporting data are true and complete to the best of my knowledge. I understand that the Conservation Commission will place notification of this Notice in a local newspaper at the expense of the applicant in accordance with the wetlands regulations, 310 CMR 10.05(5)(a).

I further certify under penalties of perjury that all abutters were notified of this application, pursuant to the requirements of M.G.L. c. 131, § 40. Notice must be made by Certificate of Mailing or in writing by hand delivery or certified mail (return receipt requested) to all abutters within 100 feet of the property line of the project location.

1. Signature of Applicant

2. Date: 4/30/26

3. Signature of Property Owner (if different)

4. Date: 4/28/26

5. Signature of Representative (if any)

6. Date: 4/28/2026

For Conservation Commission:
Two copies of the completed Notice of Intent (Form 3), including supporting plans and documents, two copies of the NOI Wetland Fee Transmittal Form, and the city/town fee payment, to the Conservation Commission by certified mail or hand delivery.

For MassDEP:
One copy of the completed Notice of Intent (Form 3), including supporting plans and documents, one copy of the NOI Wetland Fee Transmittal Form, and a **copy** of the state fee payment to the MassDEP Regional Office (see Instructions) by certified mail or hand delivery.

Other:
If the applicant has checked the "yes" box in any part of Section C, Item 3, above, refer to that section and the Instructions for additional submittal requirements.

The original and copies must be sent simultaneously. Failure by the applicant to send copies in a timely manner may result in dismissal of the Notice of Intent.

Attachment A

Project Narrative

ATTACHMENT A – PROJECT NARRATIVE

1.0 Introduction

On behalf of Moraga Storage, LLC (the "Applicant"), Epsilon Associates, Inc. ("Epsilon") submits this Notice of Intent ("NOI") to the Oakham Conservation Commission ("OCC" or "Commission") for a limited portion of work associated with the proposed battery energy storage project ("BESS") at 358 Coldbrook Road, Oakham, Massachusetts. The NOI has been prepared in accordance with the Massachusetts Wetland Protection Act ("WPA") (MGL c. 131 § 40) and Regulations (310 CMR 10.00). The filing is limited to improvements to a portion of an existing dirt/gravel access drive located within the 100-foot Buffer Zone to Bordering Vegetated Wetland ("BVW"). No work is proposed within BVW, within any other wetland resource area, or within vernal pool habitat as regulated under the Act. The wetland boundaries shown on the permit plans are based on the previously approved Order of Resource Area Delineation ("ORAD") issued under MassDEP File No. 252-0150. These are the only aspects of the Project that are within the Commission's jurisdiction under the WPA. Because the proposed work is confined to an existing disturbed access corridor, the filing does not seek approval for broader site development outside Conservation Commission jurisdiction.

Additional details are provided in the balance of this narrative and related attachments, including the permit drawings prepared by ARUP Engineering provided under separate cover in Attachments G and H, respectively. The GIS figures provided in Attachment B also depict existing conditions on and adjacent to the Project site.

2.0 Existing Conditions

The Project Site encompasses approximately 42.9 acres. It is bordered by residential properties and undeveloped forest to the west; undeveloped forest and a Massachusetts Electric d/b/a National Grid–maintained power line easement to the northeast; and undeveloped forest, marsh, and Peg Millpond to the south. The land to the northeast is owned by the Department of Conservation and Recreation ("DCR") and the Division of Water Supply Protection ("DWSP"). Surrounding land uses include conservation, recreation, municipal facilities, agriculture, and residential development.

Historically, the Project Site operated as an automobile salvage storage facility. Site access is provided by an existing paved driveway extending from Coldbrook Road. At the terminus of this access driveway are a one-story, two-bay service garage, an attached one-story office or reception building, and a separate storage shed. Much of the parcel contains unpaved driveways and former vehicle storage areas that are now overgrown with shrubs and herbaceous vegetation. Other portions of the site, particularly the southeast corner, remain largely forested but still contain areas of overgrown vegetation and evidence of past site disturbances from prior commercial operations on the site.

The limited work area that is the subject of this NOI is located along a dirt/gravel drive that has historically been used by front loaders and other vehicles and is therefore already disturbed. A portion of the drive exists within the Buffer Zone to BVW.

No portion of the Project Site is mapped as an Area of Critical Environmental Concern ("ACEC") or an Outstanding Resource Water ("ORW"). The parcel is also not located within Priority Habitat of Rare Species or Estimated Habitat of Rare Wildlife as designated by the Natural Heritage and Endangered Species Program ("NHESP").

Based on Federal Emergency Management Agency ("FEMA") community panel 2503240005B, effective April 3, 1984, the parcel does not contain any mapped Zone A or AE 100-year flood hazard areas (see Attachment B, Figure 3).

3.0 Delineated Wetland Resource Areas

Wetland resource areas associated with the Project site were delineated by Epsilon on July 21, 2023, and March 26, 2024. On October 6, 2024, an Abbreviated Notice of Resource Area Delineation ("ANRAD") was filed with the Oakham Conservation Commission and the Massachusetts Department of Environmental Protection (MassDEP File No. 252-0150). Following submittal of the ANRAD application, a site visit with the Commission was conducted on October 26, 2024. The public hearing was subsequently closed on November 6, 2024, and on December 3, 2024, the Commission issued an Order of Resource Area Delineation ("ORAD") approving the delineated wetland resource area boundaries. A copy of the ORAD and the approved ANRAD Plan are included as Attachment E.

The Applicant acknowledges that, during the EFSB evidentiary proceedings, the Town of Oakham suggested a potential BVW area outside the previously issued ORAD. Based on available data, the Applicant maintains that this area does not constitute BVW and is not shown on the plans. The Applicant also notes that, per MassDEP's April 15, 2026 email transmittal, modification of BVW boundaries within the ORAD is generally not permitted prior to its 2029 expiration. Notwithstanding, the Project has been designed to avoid alteration of the area as a conservative, good-faith measure and the proposed work complies with all applicable WPA performance standards.

The wetland resource areas were delineated in accordance with the U.S. Army Corps of Engineers Wetland Delineation Manual (USACE, 1987) and Regional Supplement, the Massachusetts Wetlands Protection Act and implementing Regulations (310 CMR 10.00), the MassDEP Handbook for Delineation of Bordering Vegetated Wetlands (Second Edition, September 2022). The Town of Oakham does not have a wetland bylaw, so the state and federal delineation methodologies apply. The state, and federal delineation methodologies prescribe a multi-parameter approach, where hydrophytic vegetation, hydrology and hydric soils are reviewed in conjunction with one another to demarcate the wetland – upland boundary.

Three Vernal Pools are located on the property that were certified by others following the issuance of the ORAD. The three Certified Vernal Pools ("CVP's") were located in the spring of 2026, and they are accurately depicted on the permit plan set. No work is proposed in these areas nor is any work proposed within the adjoining Vernal Pool Habitat as such term is defined in the WPA regulations (310 CMR 10.04).

Wetland resource areas on the Project Site include several BVW systems, delineated as W1, W2, W3, W4, and W6/W7 Series, which represent a mix of forested, scrub-shrub, and emergent wetland communities across the parcel. These systems are hydrologically interconnected in certain areas (e.g., W3 and W4) and are associated with intermittent streams and adjacent surface water features.

Additional detail regarding the delineation, characteristics, and regulatory context of these wetland systems is provided in Attachment E (ORAD) and the approved ANRAD provided in Attachment H (Stormwater Report).

4.0 Description of Proposed Activities within Jurisdictional Areas

Activities subject to the Commission's jurisdiction are limited to improvements proposed within the existing access driveway, which will be upgraded to support construction and operational activities at the site. A portion of this work is located within the 100-foot Buffer Zone to BVW. No other components of the Project are currently proposed within jurisdictional resource areas.

The Applicant proposes to improve a segment of the existing dirt/gravel driveway to a 16-foot-wide gravel construction and operations driveway typical of utility right-of-way access roads. The improvements will occur within the existing disturbed corridor and will consist of grading, placement of compacted fill as needed to establish the section, installation of a gravel subbase and top course, and shaping of the surface to provide stable access for construction and operations. Based on a typical cross section, the driveway will consist generally of a crowned gravel surface over compacted subbase, with sloped shoulders transitioning to existing grade. The purpose of the work is to stabilize and formalize an existing access route rather than create a new one in an undisturbed area. No alteration of BVW is proposed. No fill, grading, excavation, or other work will occur within the BVW boundary, and all activities have been specifically designed to avoid and protect this resource area. Work is limited to the Buffer Zone, with the limits of disturbance clearly identified on the plan set and will be demarcated in the field with sediment controls to ensure no encroachment into BVW occurs during construction.

The Applicant has proactively incorporated stormwater management measures to prevent potential impacts to adjacent wetlands. No components of the proposed stormwater management system, including discharge points and conveyance features associated with construction and operation of the BESS facility, are located within jurisdictional resource areas. Additional detail are provided in the Stormwater Management Report included as Attachment H.

Please also refer to the permit drawings provided in Attachments G and H for additional detail.

5.0 Summary of Proposed Mitigation Measures

Although most of the following best management practices ("BMP's") are anticipated to be implemented outside the 100-foot Buffer Zone, they are included for informational purposes should any work occur within the Buffer Zone requiring such measures.

5.1 Sediment Controls and Erosion Prevention Measures

An erosion and sedimentation control program will minimize the risk of impacts to wetland resource areas during construction. The Applicant's erosion and sedimentation control program incorporates BMPs specified in guidelines developed by the MassDEP and the United States Environmental Protection Agency ("USEPA") and will comply with the requirements of the National Pollutant Discharge Elimination System ("NPDES") General Permit for Storm Water Discharges from Construction Activities. These measures will include the installation of temporary sediment controls (e.g., silt fence, compost filter tubes, inlet protection devices), erosion prevention measures (e.g., seeding, stone), and construction sequencing. Tracking pads will be installed at the primary entrance and exit point to minimize the transport of sediment onto adjacent roadway surfaces. Sediment controls are depicted on the enclosed permit drawings in Attachments G and H, respectively.

5.2 Dewatering Protocols

To the extent construction dewatering is determined to be necessary, the type of dewatering BMP will be selected by the site contractor at the time of construction based on site specific factors and the volume of water to be collected and treated. The site contractor will also be required to adhere to the following minimum performance standards:

- Do not discharge visible floating solids,
- Do not discharge directly into adjacent jurisdictional areas or catch basins that discharge into adjacent jurisdictional areas, and
- Velocity dissipation devices (e.g., check dams, riprap) shall be used as necessary to provide a non-erosive flow velocity at any outlet where dewatering water is discharged.

5.3 Soil and Construction Material Stockpile Locations

The soil and construction material stockpile locations will be located outside of the 100-foot Buffer Zone and surrounded by sediment controls and/or temporary construction fencing to prevent inadvertent encroachments into the Buffer Zone. There will be no storage of soil, concrete, or construction materials within wetland resource areas. Construction debris will typically be placed in large roll-off containers (or dumpsters) and removed by a contract hauler.

5.4 Construction Monitoring

The proposed Project includes preparation and implementation of a Stormwater Pollution Prevention Plan ("SWPPP") that identifies the controls and BMPs to be implemented to minimize the potential for erosion and sedimentation associated with site disturbance. A qualified environmental inspector will conduct regular site inspections to ensure compliance with construction procedures, the Project SWPPP, and all applicable permit conditions.

5.5 Snow Storage

Snow storage areas will be located outside of the 100-foot Buffer Zone to avoid potential impacts to adjacent wetland resource areas.

6.0 Bordering Vegetated Wetlands and Buffer Zone Compliance (310 CMR 10.55 and 310 CMR 10.02(2)(b)3)

The Project has been designed to avoid impacts to BVW and to protect the interests of the WPA. All proposed work associated with the access drive improvements is confined to the Buffer Zone, with no alteration, filling, excavation, or permanent disturbance proposed within BVW resource areas. Accordingly, the regulatory provisions related to wetland replication, mitigation, and limited wetland loss are not applicable to the Project.

The work within the Buffer Zone has been limited to previously disturbed and developed areas associated with the existing access drive in order to minimize disturbance adjacent to wetland resources. A clearly defined limit of work will be established in the field prior to construction, and erosion and sedimentation controls will be installed and maintained throughout construction to prevent sediment transport or runoff into adjacent wetlands. Existing vegetation adjacent to the BVW will be preserved to the maximum extent practicable, and construction activities will be managed to avoid indirect impacts to wetland functions and values during and after construction.

The Project does not involve work within Vernal Pool Habitat, mapped Estimated Habitat for State-listed Species and is not located within an Area of Critical Environmental Concern. Given the limited scope of work, the existing developed character of the Buffer Zone, and the implementation of erosion and sedimentation controls and other protective measures, the Project will not adversely affect adjacent wetland resource areas and is consistent with the performance standards and intent of 310 CMR 10.55 and 310 CMR 10.02(2)(b)3.

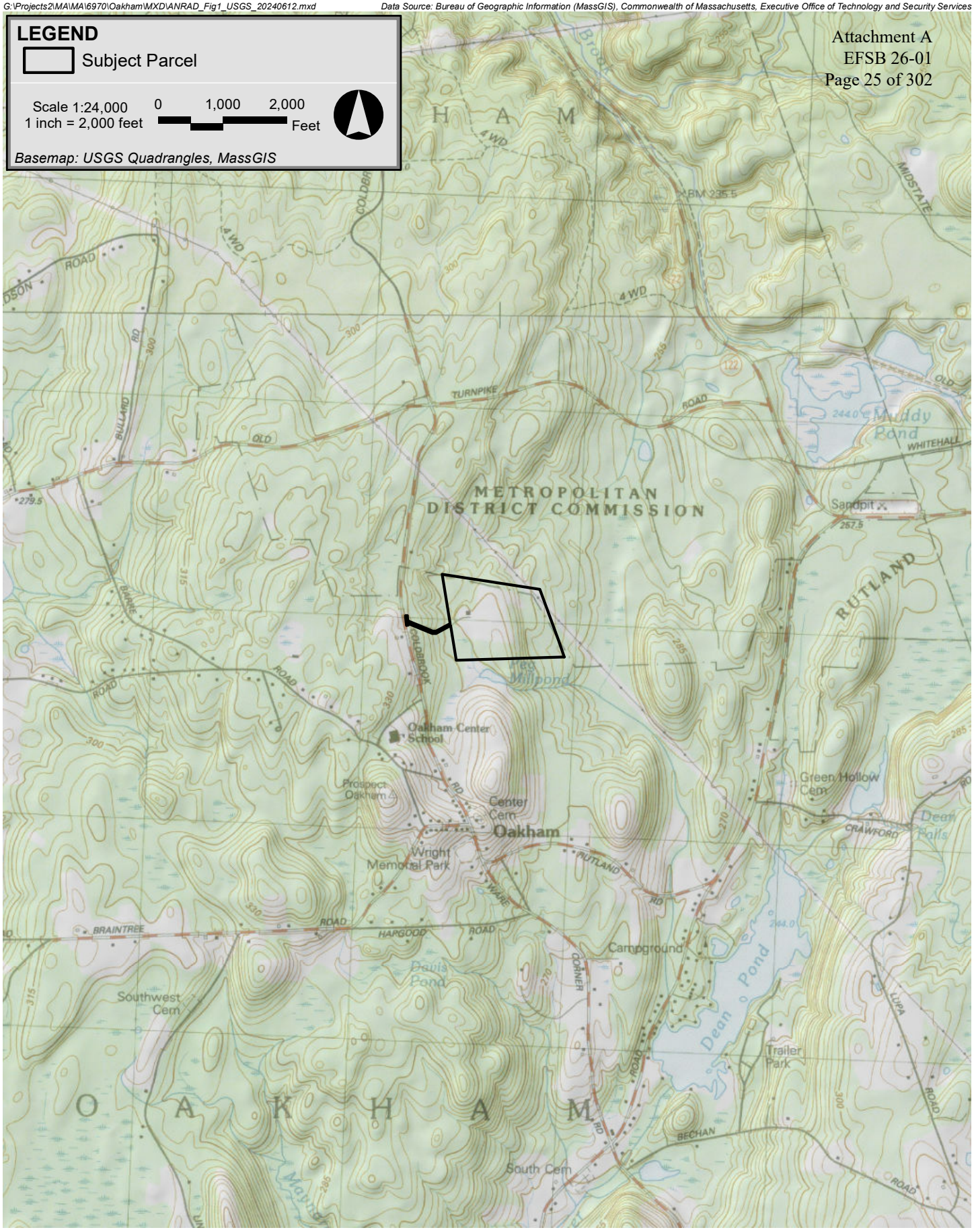
7.0 Conclusions

The information submitted with this NOI and the accompanying site plans demonstrates that the Project has been designed to fully comply with all applicable performance standards of the WPA and its implementing regulations. The materials provided adequately document existing site conditions, the proposed work, and the avoidance, minimization, and mitigation measures incorporated into the Project design, and show that no adverse impacts to wetland resource areas

or the interests protected by the Act are anticipated. Based on this documentation, the Applicant respectfully requests that the Commission issue an Order of Conditions approving the Project, with such reasonable conditions as the Commission deems appropriate to ensure continued compliance with and protection of the interests of the WPA.

Attachment B

Figures

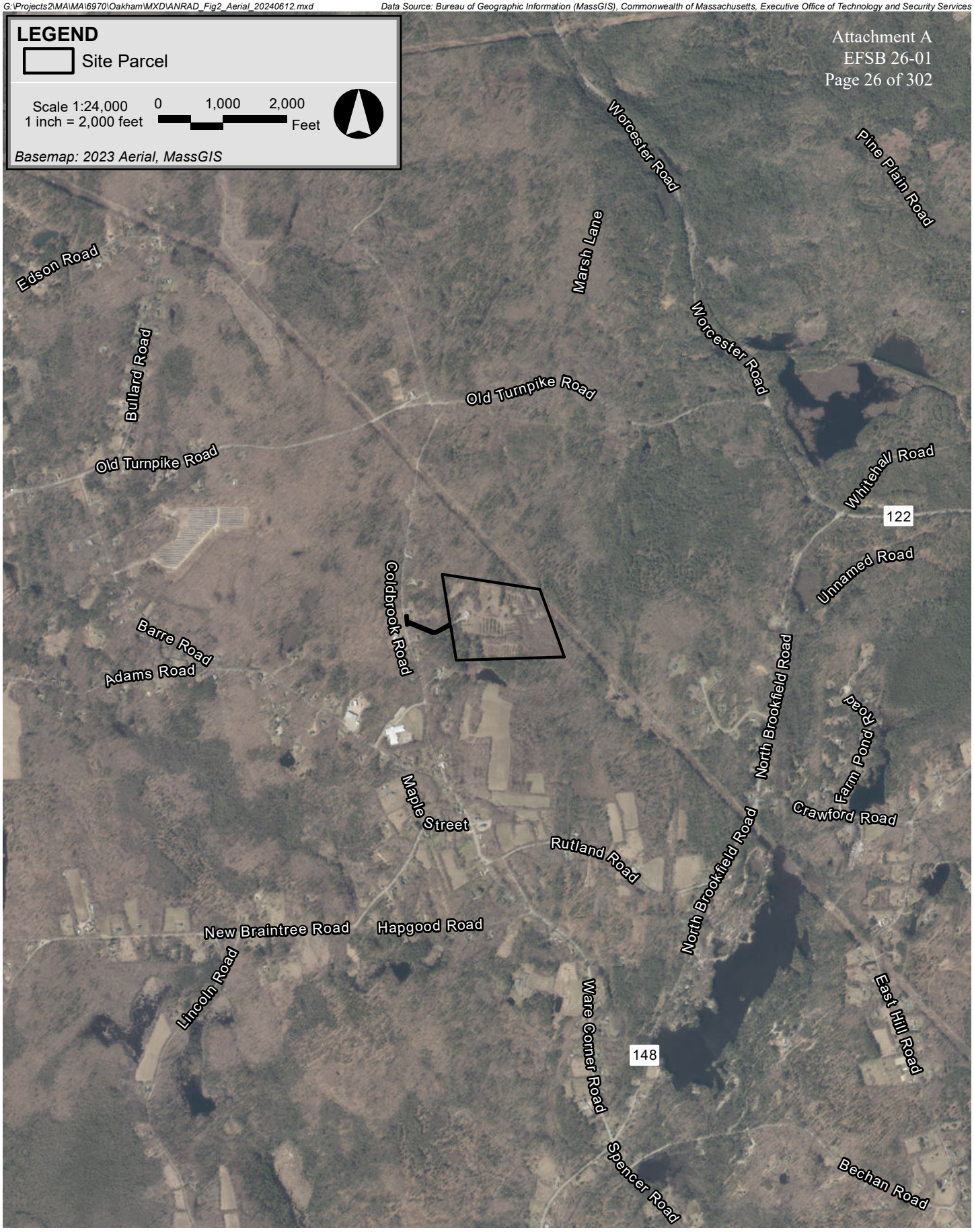


358 Coldbrook Road Oakham, Massachusetts

Epsilon Associates Inc.

Figure 1
USGS Locus Map

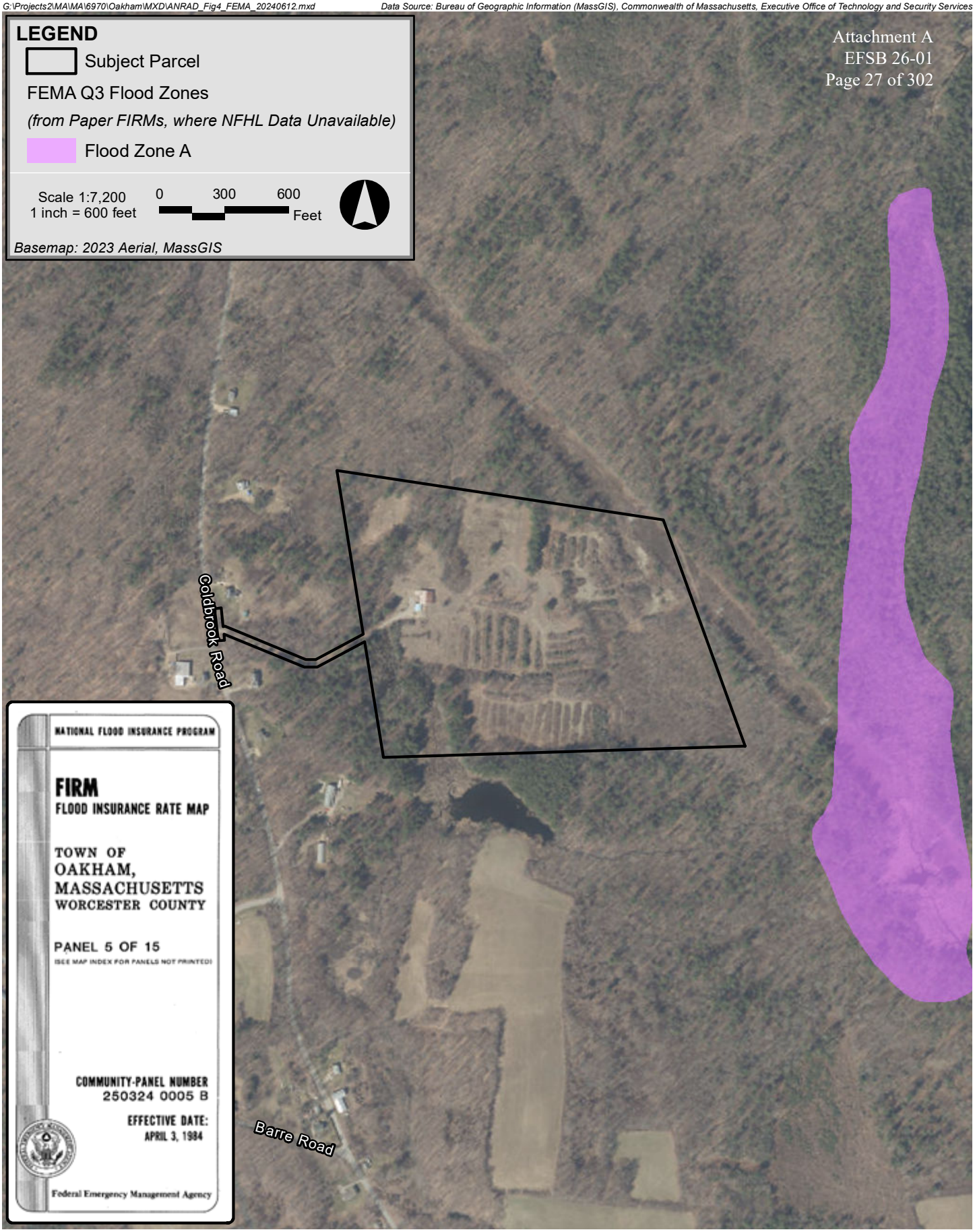
Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services



358 Coldbrook Road Oakham, Massachusetts

Epsilon Associates Inc.

Figure 2
Aerial Locus Map

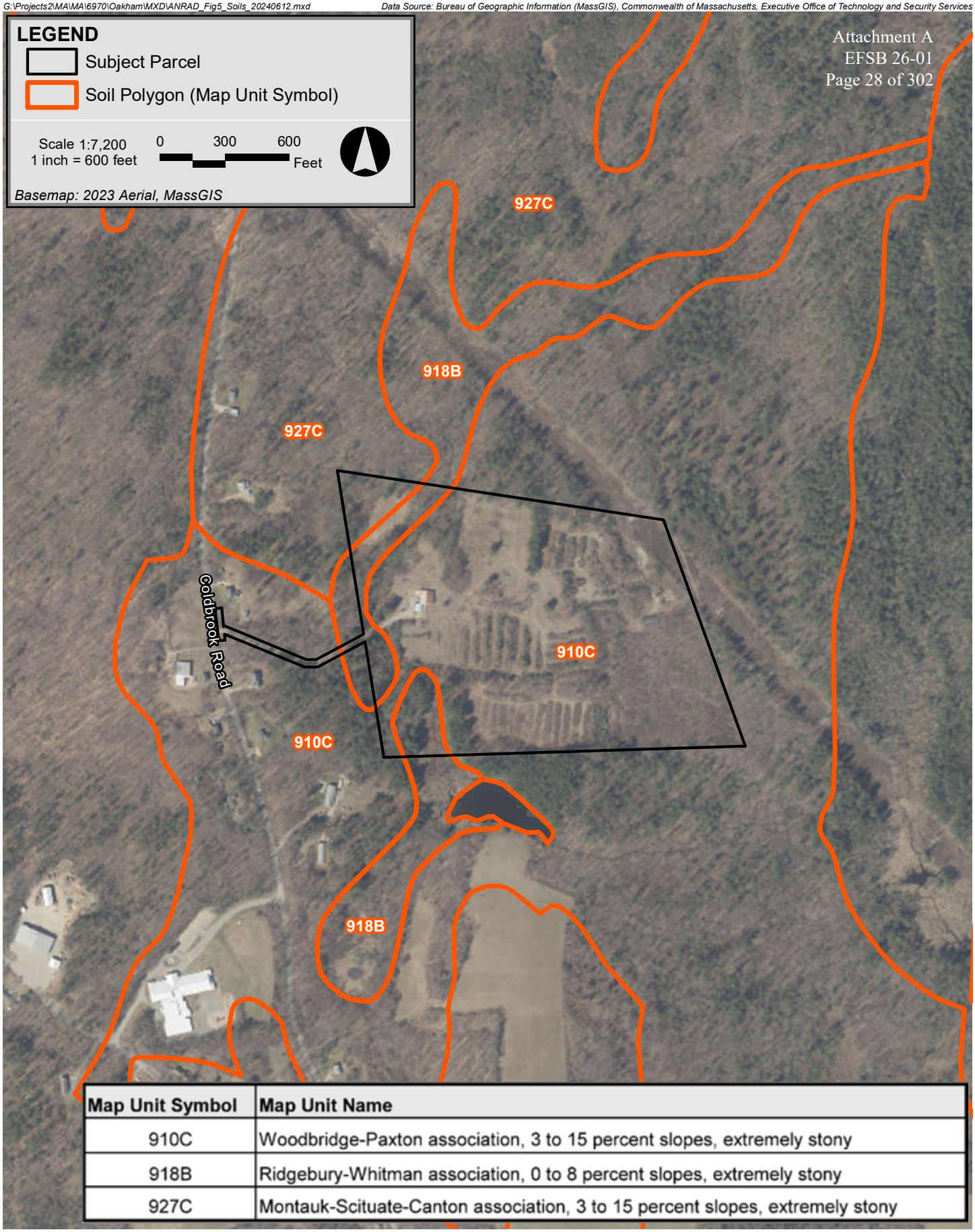


358 Coldbrook Road Oakham, Massachusetts

Epsilon Associates Inc.

Figure 3
FEMA Flood Zones
(FIRM Panel 250324 0005 B - April 3, 1984)

Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services



Map Unit Symbol	Map Unit Name
910C	Woodbridge-Paxton association, 3 to 15 percent slopes, extremely stony
918B	Ridgebury-Whitman association, 0 to 8 percent slopes, extremely stony
927C	Montauk-Scituate-Canton association, 3 to 15 percent slopes, extremely stony

358 Coldbrook Road Oakham, Massachusetts

Epsilon Associates Inc.

Figure 4
NRCS SSURGO-Certified Soils

Attachment C

Abutter Information

AFFIDAVIT OF SERVICE

Under the Massachusetts Wetlands Protection Act

(To be submitted to the Massachusetts Department of Environmental Protection and the Conservation Commission when filing a Notice of Intent)

I, Greg J. Hochmuth, Epsilon Associates, Inc., hereby certify under the
(Name of person making the Affidavit)

pains and penalties of perjury that on May 12, 2026 I gave notification to abutters
(Date)

in compliance with the second paragraph of Massachusetts General Laws Chapter 131, Section 40, and the DEP Guide to Abutter Notification dated April 8, 1994, in connection with the following matter:

A Notice of Intent filed under the Massachusetts Wetlands Protection Act by

Moraga Storage, LLC with the Oakham
(Name of Applicant) (Name of Municipality)

Conservation Commission on May 12, 2026 for property located at

358 Coldbrook Road
(Address of land where work is proposed)

The form of the notification and a list of the abutters to whom it was given and their addresses, are attached to this Affidavit of Service.

Greg J. Hochmuth
(Name)

May 12, 2026
(Date)

Notification to Abutters

By Hand Delivery, Certified Mail (return receipt requested), or Certificates of Mailing

This is a notification required by law. You are receiving this notification because you have been identified as the owner of land abutting another parcel of land for which certain activities are proposed. Those activities require a permit under the Massachusetts Wetlands Protection Act (M.G.L. c. 131, § 40).

In accordance with the second paragraph of the Massachusetts Wetlands Protection Act, and 310 CMR 10.05(4)(a) of the Wetlands Regulations, you are hereby notified that:

A. A Notice of Intent was filed with the Oakham Conservation Commission on May 12, 2026 seeking permission to remove, fill, dredge, or alter an area subject to protection under M.G.L. c. 131 §40. The following is a description of the proposed activity/activities:

> The Applicant proposes to construct a 180-megawatt, four-hour Battery Energy Storage System ("BESS") and associated electrical infrastructure (the "Project") on approximately 18 acres of a 42.9-acre parcel off Coldbrook Road, 358 Coldbrook Road, in Oakham, Massachusetts (the "Project Site"). As part of the Project, a portion of the existing gravel access roadway that crosses the 100-foot Buffer Zone to Bordering Vegetated Wetlands will be improved and is therefore subject to the jurisdiction of the Massachusetts Wetlands Protection Act ("WPA").

B. The name of the applicant is: Moraga Storage, LLC.

C. The address of the land where the activity is proposed is: 358 Coldbrook Road, Assessors Map 406, Parcel 106.3.

D. Copies of the Notice of Intent may be examined or obtained at the office of the Oakham Conservation Commission, located at 2 Coldbrook Road, Unit 7, Oakham, MA 01068. The Conservation Commission does not hold regular business hours, so please call 508-882-5549 to request an appointment or email at: conservation@oakham-ma.gov.

E. Copies of the Notice of Intent may be obtained from the applicant by calling 401.215.4000. An administrative fee may be applied for providing copies of the NOI and plans.

F. Information regarding the date, time, and location of the public hearing regarding the Notice of Intent may be obtained from the Oakham Conservation Commission. Notice of the public hearing will be published at least five business days in advance, in the Barre Gazette.

Notification provided pursuant to the above requirement does not automatically confer standing to the recipient to request Departmental Action for the underlying matter. See 310 CMR 10.05(7)(a)4.

Property Location 358 COLDBROOK ROAD | Map ID 406/ / 106.3/ / | Bldg Name | State Use 3330
Vision ID 288 | Account # 406-106.3 | Bldg # 1 | Sec # 1 of 1 | Card # 1 of 1 | Print Date 4/21/2026 3:04:46 PM

VISION

CURRENT OWNER

ZOVL Properties, LLC

5555 Anglers Avenue

Suite 27

Fort Lauderdale FL 33312

TOPO	UTILITIES	STRT / ROAD	LOCATION
4 Rolling	5 Well	1 Paved	3 Rural
	6 Septic		

SUPPLEMENTAL DATA

Alt Prcl ID 2224060000001063
Sub-Div
Photo
Ward
Prec.
PLBK/PL 575/122
GIS ID M_155417_901418 Assoc Pid#

CURRENT ASSESSMENT

Description	Code	Appraised	Assessed
COMMERC.	3330	132,100	132,100
COM LAND	3330	614,500	614,500
COMMERC.	3330	4,800	4,800
	Total	751,400	751,400

RECORD OF OWNERSHIP

RECORD OF OWNERSHIP	BK-VOL/PAGE		SALE DATE	Q/U	V/I	SALE PRICE	VC
ZOVL Properties, LLC	67682	276	06-01-2022	U	I	1,400,000	1
PALLEY, CYNTHIA A.	21277	0356	09-10-1990	U	V	100	1F
PALLEY, CYNTHIA A.	12988	0370	09-10-1990	U	V	100	1A
WAREING, WILLIAM N..	0	0			V	0	
PALLEY,GORDON	0	0				0	

PREVIOUS ASSESSMENTS (HISTORY)

Year	Code	Assessed	Year	Code	Assessed	Year	Code	Assessed
2025	3330	132,100	2025	3330	126,400	2024	3330	123,600
	3330	614,500		3330	494,600		3330	491,600
	3330	4,800		3330	4,800		3330	4,800
	Total	751,400		Total	625,800		Total	620,000

EXEMPTIONS

Year	Code	Description	Amount
		Total	0.00

OTHER ASSESSMENTS

Code	Description	Number	Amount	Comm Int

This signature acknowledges a visit by a Data Collector or Assessor

ASSESSING NEIGHBORHOOD

Nbhd	Nbhd Name	B	Tracing	Batch
0001				

APPRAISED VALUE SUMMARY

Appraised Bldg. Value (Card)	132,100
Appraised Xf (B) Value (Bldg)	0
Appraised Ob (B) Value (Bldg)	4,800
Appraised Land Value (Bldg)	614,500
Special Land Value	0
Total Appraised Parcel Value	751,400
Valuation Method	C
Total Appraised Parcel Value	751,400

NOTES

AMHERST-OAKHAM
AUTO RECYCLING---GONE
BY SPECIAL PERMIT
OUT OF BUSINESS FY21
LITTLE FRONTAGE
VACANT FENCED

BUILDING PERMIT RECORD

Permit Id	Issue Date	Type	Description	Amount	Insp Date	% Comp	Date Comp	Comments
9522	10-21-1994	AD	Addition	25,000		100		Addition for business 34x24x1
9420	10-20-1993	NC	New Construct	1,500		100		Shed 12x60x8.

VISIT / CHANGE HISTORY

Date	Id	Type	Is	Cd	Purpost/Result
06-05-2025	PH	02	6	02	Measur+2Visit - Info Card I
07-07-2023	PH	02	6	11	Sales Review
06-11-2013	PH	02		40	No change
09-19-2008	PH	02		01	Measur+1Visit

LAND LINE VALUATION SECTION

B	Use Code	Description	Zone	Land Type	Land Units		Unit Price	I. Factor	Site Index	Cond.	Nbhd.	Nbhd Adj	Notes	Location Adjustment		Adj Unit Pric	Land Value
1	3330	FUEL SV/PR		Primary	3.000	AC	120,315.00	0.36278	5	1.00	C3	1.150	SITE		0		150,600
1	3330	FUEL SV/PR			9.000	AC	120,315.00	0.15091	5	1.00	C3	1.150	SITE		0		182,200
1	3330	FUEL SV/PR			30.850	AC	120,315.00	0.07587	5	1.00		1.000	SHAPE		0		281,700
				Total Card Land Units	42.850	AC	Parcel Total Land Area:			42.850						Total Land Value	614,500

Property Location 358 COLDBROOK ROAD | Map ID 406/ / 106.3/ / | Bldg Name | State Use 3330
Vision ID 288 | Account # 406-106.3 | Bldg # 1 | Sec # 1 of 1 | Card # 1 of 1 | Print Date 4/21/2026 3:04:47 PM

CONSTRUCTION DETAIL

Element	Cd	Description
Style:	25	Service Shop
Model	96	Industrial
Grade	03	Average
Stories:	1	
Occupancy	1.00	
Exterior Wall 1	27	Pre-finsh Metl
Exterior Wall 2		
Roof Structure	03	Gable/Hip
Roof Cover	01	Metal/Tin
Interior Wall 1	01	Minim/Masonry
Interior Wall 2		
Interior Floor 1	03	Concr-Finished
Interior Floor 2		
Heating Fuel	02	Oil
Heating Type	03	Hot Air-no Duc
AC Type	01	None
Bldg Use	3330	FUEL SV/PR
Total Rooms		
Total Bedrms		
Total Baths		
Fireplaces:		
Bsmt Garage:		
Heat/AC	00	NONE
Frame Type	05	STEEL
Baths/Plumbing	02	AVERAGE
Ceiling/Wall	00	NONE
Rooms/Prtns	02	AVERAGE
Wall Height	10.00	
% Comn Wall		
1st Floor Use:		

CONSTRUCTION DETAIL (CONTINUED)

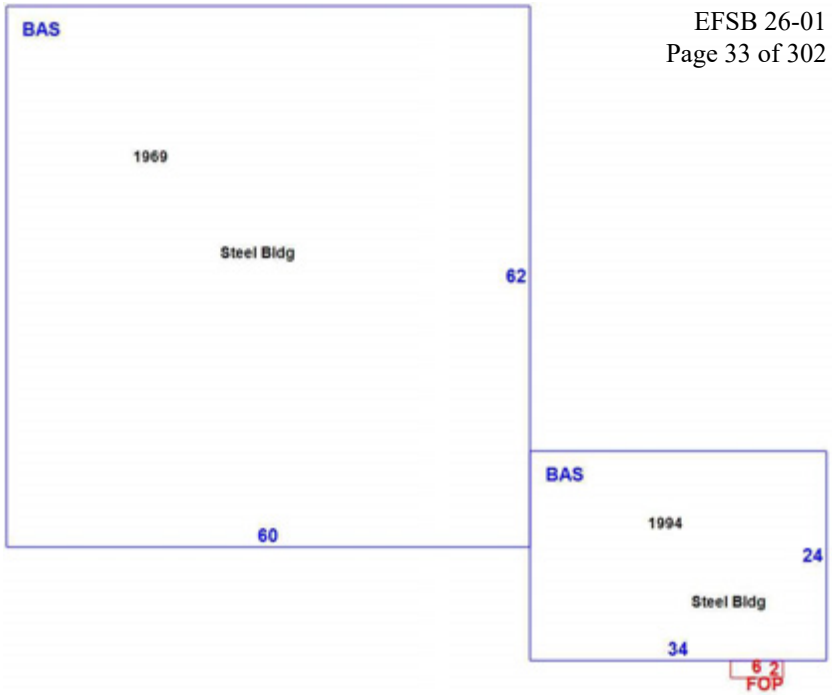
Element	Cd	Description

MIXED USE

Code	Description	Percentage
3330	FUEL SV/PR	100
		0
		0

COST / MARKET VALUATION

RCN	183,421
Year Built	1969
Effective Year Built	
Depreciation Code	A
Remodel Rating	
Year Remodeled	
Depreciation %	28
Functional Obsol	0
External Obsol	0
Trend Factor	1
Condition	
Condition %	
Percent Good	72
Cns Sect Rcnld	132,100
Dep % Ovr	
Dep Ovr Comment	
Misc Imp Ovr	
Misc Imp Ovr Comment	
Cost to Cure Ovr	
Cost to Cure Ovr Comment	



OB - OUTBUILDING & YARD ITEMS(L) / XF - BUILDING EXTRA FEATURES(B)

Code	Description	L/B	Units	Unit Price	Yr Blt	Cond. Cd	% Good	Grade	Grade Adj	Appr. Value
SHD1	SHED FRAME	L	720	8.00	1993	00	50	00	1.00	2,900
SHD1	SHED FRAME	L	320	8.00	1997	00	50	00	1.00	1,300
SGN2	DOUBLE SIDE	L	32	35.00	1997	00	50	00	1.00	600

BUILDING SUB-AREA SUMMARY SECTION

Code	Description	Living Area	Floor Area	Eff Area	Unit Cost	Undeprec Value
BAS	First Floor	4,536	4,536		40.41	183,300
FOP	Porch, Open, Finished	0	12		10.10	121
	Ttl Gross Liv / Lease Area	4,536	4,548			183,421

map_par_id	site_addr	owner1	own_addr	own_city	own_	own_zip
406/108	0 COLDBROOK ROAD	BLACK, HAROLD C.	236 COLDBROOK ROAD	OAKHAM	MA	01068
406/104	0 OLD TURNPIKE ROAD	MASSACHUSETTS, COMMONWEALTH OF	20 SOMERSET STREET (WATER DIVISION)	BOSTON	MA	02108
406/93	244 BARRE ROAD	MARTIN, GERALD A.	244 BARRE ROAD	OAKHAM	MA	01068
406/15	215 BARRE ROAD	CREED, DENNIS C, & ANN-MARIE S.	215 BARRE ROAD	OAKHAM	MA	01531
406/14.2	181 BARRE ROAD	GEHRING, FREDERICK J. AND TAMMY J.	181 BARRE ROAD	OAKHAM	MA	01068
406/94	212 BARRE ROAD	LEBLANC, GARY R. & WENDY J. TRUSTEES	212 BARRE ROAD	OAKHAM	MA	01068
406/95	178 BARRE ROAD	OAKHAM, TOWN OF (HIGHWAY BARN)	PO BOX 191	OAKHAM	MA	01068
406/96	108 COLDBROOK ROAD	OAKHAM, TOWN OF (SCHOOL)	PO BOX 205	OAKHAM	MA	01515
406/108.3	0 COLDBROOK ROAD	BLACK, CHRISTOPHER & CHRISTINE	PO BOX 81	SOUTH BARRE	MA	01074
406/106.3	358 COLDBROOK ROAD	ZOVL Properties, LLC	5555 Anglers Avenue	Fort Lauderdale	FL	33312
406/108.1	236 COLDBROOK ROAD	BLACK, HAROLD C.	236 COLDBROOK ROAD	OAKHAM	MA	01068
406/105	444 COLDBROOK ROAD	RICE, CLAYTON E. & MELANIE J.	444 COLDBROOK ROAD	OAKHAM	MA	01068
406/106	390 COLDBROOK ROAD	WISNEWSKI, MATTHEW	PO BOX 131	OAKHAM	MA	01068
406/106.1	360 COLDBROOK ROAD	STEVENS, JAMES R.	360 COLDBROOK ROAD	OAKHAM	MA	01068
406/106.4	276 COLDBROOK ROAD	COREY, SCOTT H. & SHARON M.	276 COLDBROOK ROAD	OAKHAM	MA	01068
406/106.2	300 COLDBROOK ROAD	HAAPAKOSKI, DONALD A. & NANCY E.	PO BOX 243	OAKHAM	MA	01068
406/101	251 COLDBROOK ROAD	TYCK, JONATHAN	251 COLDBROOK ROAD	OAKHAM	MA	01068
406/102.1	291 COLDBROOK ROAD	UPTON, MARK H.	BOX 213	OAKHAM	MA	01068
406/102	307 COLDBROOK ROAD	HUARD, BRIAN G.	307 COLDBROOK ROAD	OAKHAM	MA	01068
406/103	0 OLD TURNPIKE ROAD	MASSACHUSETTS, COMMONWEALTH OF	20 SOMERSET STREET	BOSTON	MA	02108
406/91	0 BARRE ROAD	LEBLANC, GARY R. & WENDY J. TRUSTEES	212 BARRE ROAD	OAKHAM	MA	01068
406/90	298 BARRE ROAD	THE BARRE ROAD, LLC	ONE INTERNATIONAL PLACE, SUITE 3220	BOSTON	MA	02110

map_par_id	site_addr	owner1	own_addr	own_city	own_	own_zip
406/108	0 COLDBROOK ROAD	BLACK, HAROLD C.	236 COLDBROOK ROAD	OAKHAM	MA	01068
406/104	0 OLD TURNPIKE ROAD	MASSACHUSETTS, COMMONWEALTH OF	20 SOMERSET STREET (WATER DIVISION)	BOSTON	MA	02108
406/93	244 BARRE ROAD	MARTIN, GERALD A.	244 BARRE ROAD	OAKHAM	MA	01068
406/15	215 BARRE ROAD	CREED, DENNIS C, & ANN-MARIE S.	215 BARRE ROAD	OAKHAM	MA	01531
406/14.2	181 BARRE ROAD	GEHRING, FREDERICK J. AND TAMMY J.	181 BARRE ROAD	OAKHAM	MA	01068
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406/108.3	0 COLDBROOK ROAD	BLACK, CHRISTOPHER & CHRISTINE	PO BOX 81	SOUTH BARRE	MA	01074
406/106.3	358 COLDBROOK ROAD	ZOVL Properties, LLC	5555 Anglers Avenue	Fort Lauderdale	FL	33312
406/108.1	236 COLDBROOK ROAD	BLACK, HAROLD C.	236 COLDBROOK ROAD	OAKHAM	MA	01068
406/105	444 COLDBROOK ROAD	RICE, CLAYTON E. & MELANIE J.	444 COLDBROOK ROAD	OAKHAM	MA	01068
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406/106.1	360 COLDBROOK ROAD	STEVENS, JAMES R.	360 COLDBROOK ROAD	OAKHAM	MA	01068
406/106.4	276 COLDBROOK ROAD	COREY, SCOTT H. & SHARON M.	276 COLDBROOK ROAD	OAKHAM	MA	01068
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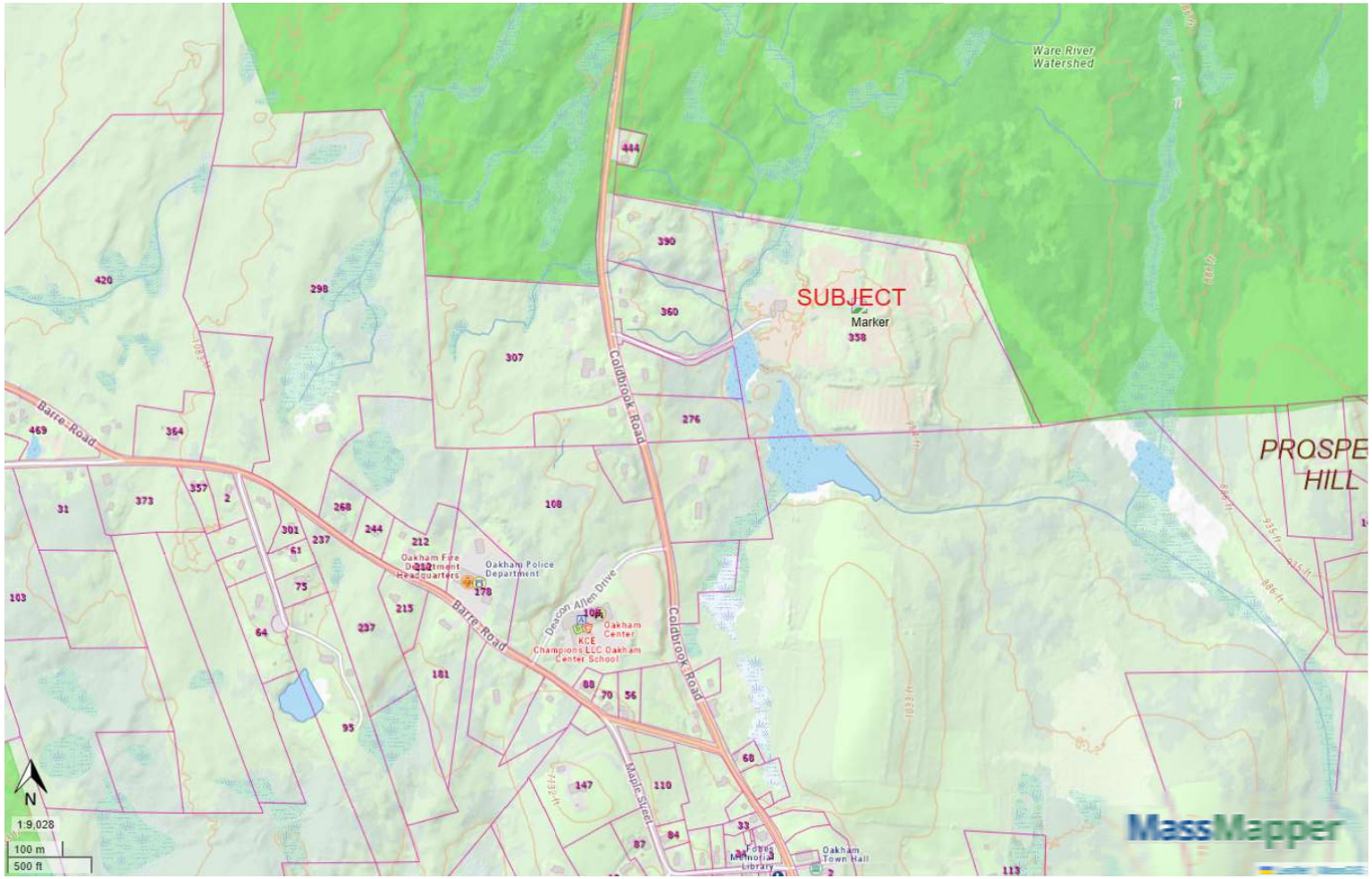
406/102.1	291 COLDBROOK ROAD	UPTON, MARK H.	BOX 213	OAKHAM	MA	01068
406/102	307 COLDBROOK ROAD	HUARD, BRIAN G.	307 COLDBROOK ROAD	OAKHAM	MA	01068
406/103	0 OLD TURNPIKE ROAD	MASSACHUSETTS, COMMONWEALTH OF	20 SOMERSET STREET	BOSTON	MA	02108
406/91	0 BARRE ROAD	LEBLANC, GARY R. & WENDY J. TRUSTEES	212 BARRE ROAD	OAKHAM	MA	01068
406/90	298 BARRE ROAD	THE BARRE ROAD, LLC	ONE INTERNATIONAL PLACE, SUITE 3220	BOSTON	MA	02110

358 Coldbrook Rd

Property Tax Parcels



Printed Apr 21, 2026

Oakham
Town Hall
2 Coldbrook Road, Unit 1
Oakham, MA 01068
Phone: 508-882-5549

APPLICATION FOR CERTIFIED ABUTTERS LIST

Reason for abutters list and how many feet (please specify):
Notice of Intent Filing to Oakham Conservation Commission under the Massachusetts Wetlands Protection Act and its Regulations.
We request abutters list for all parcels within 100-Feet of Project Site as per 310 CMR 10.05(4)(a)

SUBJECT PROPERTY:

OWNER: ZOVL Properties, LLC, 5555 Anglers Avenue, Ft. Lauderdale, FL 33312

LOCATION: 358 Coldbrook Road

PARCEL ID (IF KNOWN): 406-106.3

APPLICANT's (Representative)

NAME: Marc Bergeron

MAILING ADDRESS: Epsilon Associates

PHONE NUMBER: 978-461-6253

EMAIL ADDRESS: mbergeron@epsilonassociates.com

The Assessor's Office has ten (10) days from the date of request received to provide the list.

Fee- $25 (Check made payable to "The Town of Oakham")

ASSESSOR'S USE ONLY

DATE FEE RECEIVED: 4/21/26

CASH: _____ CHECK: ✓ #060355

Attachment D

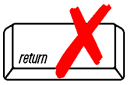
Filing Fee

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

NOI Wetland Fee Transmittal Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A. Applicant Information

1. Location of Project:

358 Coldbrook Road	Oakham
a. Street Address	b. City/Town
060589	$237.50
c. Check number	d. Fee amount

2. Applicant Mailing Address:

Gus		Hadidi	
a. First Name		b. Last Name	
Moraga Storage, LLC			
c. Organization			
800 N. King Street, Suite 304			
d. Mailing Address			
Wilmington	DE	19801	
e. City/Town	f. State	g. Zip Code	
401.215.4000		ghadidi@rhynland.com	
h. Phone Number	i. Fax Number	j. Email Address	

3. Property Owner (if different):

a. First Name		b. Last Name	
ZOVL Properties, LLC			
c. Organization			
5555 Anglers Avenue, Suite 27			
d. Mailing Address			
Fort Lauderdale	FL	33312	
e. City/Town	f. State	g. Zip Code	
h. Phone Number	i. Fax Number	j. Email Address	

B. Fees

To calculate filing fees, refer to the category fee list and examples in the instructions for filling out WPA Form 3 (Notice of Intent).

Fee should be calculated using the following process & worksheet. ***Please see Instructions before filling out worksheet.***

Step 1/Type of Activity: Describe each type of activity that will occur in wetland resource area and buffer zone.

Step 2/Number of Activities: Identify the number of each type of activity.

Step 3/Individual Activity Fee: Identify each activity fee from the six project categories listed in the instructions.

Step 4/Subtotal Activity Fee: Multiply the number of activities (identified in Step 2) times the fee per category (identified in Step 3) to reach a subtotal fee amount. Note: If any of these activities are in a Riverfront Area in addition to another Resource Area or the Buffer Zone, the fee per activity should be multiplied by 1.5 and then added to the subtotal amount.

Step 5/Total Project Fee: Determine the total project fee by adding the subtotal amounts from Step 4.

Step 6/Fee Payments: To calculate the state share of the fee, divide the total fee in half and subtract $12.50. To calculate the city/town share of the fee, divide the total fee in half and add $12.50.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

NOI Wetland Fee Transmittal Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

B. Fees (continued)

Step 1/Type of Activity	Step 2/Number of Activities	Step 3/Individual Activity Fee	Step 4/Subtotal Activity Fee
Category 2. j.	1	$500.00	$500.00

Step 5/Total Project Fee: $500.00

Step 6/Fee Payments:

Total Project Fee:	$500.00 (a. Total Fee from Step 5)
State share of filing Fee:	$237.50 (b. 1/2 Total Fee **less $**12.50)
City/Town share of filling Fee:	$262.50 (c. 1/2 Total Fee **plus** $12.50)

C. Submittal Requirements

a.) Complete pages 1 and 2 and send with a check or money order for the state share of the fee, payable to the Commonwealth of Massachusetts.

Department of Environmental Protection
Box 4062
Boston, MA 02211

b.) **To the Conservation Commission:** Send the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and the city/town fee payment.

To MassDEP Regional Office (see Instructions): Send a copy of the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and a **copy** of the state fee payment. (E-filers of Notices of Intent may submit these electronically.)

SECURITY FEATURES INCLUDE TRUE WATERMARK PAPER, HEAT SENSITIVE ICON AND FOIL HOLOGRAM.

Epsilon
ASSOCIATES INC.
3 MILL & MAIN PLACE, SUITE 250
MAYNARD, MA 01754

MIDDLESEX SAVINGS BANK
Concord, MA 01742
53-7122/2113

060590

DATE
May 11, 2026

PAY Two Hundred Sixty Two and 50/100 Dollars

AMOUNT
262.50

TO THE ORDER OF Town of Oakham

[redacted]

Details on Back. Security Features Included

SECURITY FEATURES INCLUDE TRUE WATERMARK PAPER, HEAT SENSITIVE ICON AND FOIL HOLOGRAM.

Epsilon
ASSOCIATES INC.
3 MILL & MAIN PLACE, SUITE 250
MAYNARD, MA 01754

MIDDLESEX SAVINGS BANK
Concord, MA 01742
53-7122/2113

060589

DATE
May 11, 2026

PAY Two Hundred Thirty Seven and 50/100 Dollars

AMOUNT
237.50

TO THE ORDER OF Commonwealth of Massachusetts

[redacted]

Details on Back. Security Features Included

Attachment E

Order of Resource Area Delineation

MassDEP File #: 252-0150

2024 00105652
Bk: 71437 Pg: 135
Page: 1 of 4 12/18/2024 03:05 PM WD

For Registry of Deeds Use Only

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 4B – Order of Resource Area Delineation

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number: 252-0150
eDEP Transaction Number:
City/Town: Oakham

A. General Information

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

Note: Before completing this form consult your local Conservation Commission regarding any municipal bylaw or ordinance.

From: Oakham
1. Conservation Commission

2. This Issuance is for (check one):

a. ☒ Order of Resource Area Delineation

b. ☐ Amended Order of Resource Area Delineation

3. Applicant:

Gus — a. First Name
Hadidi — b. Last Name
Moraga Storage LLC — c. Organization
750 Lexington Avenue, 9th Floor — d. Mailing Address
New York — e. City/Town
NY — f. State
10022 — g. Zip Code

4. Property Owner (if different from applicant):

a. First Name
b. Last Name
ZOVL Properties, LLC — c. Organization
5555Anglers Avenue — d. Mailing Address
Fort Lauderdale — e. City/Town
FL — f. State
33312 — g. Zip Code

5. Project Location: Book: 67682 Page: 276

358 Coldbrook Rd — a. Street Address
Oakham — b. City/Town
01068 — c. Zip Code
406 — d. Assessors Map/Plat Number
106.3 — e. Parcel/Lot Number
Latitude and Longitude (in degrees, minutes, seconds): 42.362319d m s
72 041833d m s

6. Dates:
10/6/24 — a. Date ANRAD filed
11/6/24 — b. Date Public Hearing Closed
12/4/24 — c. Date of Issuance

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 4B – Order of Resource Area Delineation

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

MassDEP File Number: 252-0150
eDEP Transaction Number:
City/Town: Oakham

A. General Information (cont.)

7. Title and Date (or Revised Date if applicable) of Final Plans and Other Documents:

a. Title: Wetland Delineation Map	b. Date: 5/14/2019
c. Title:	d. Date:

B. Order of Delineation

1. The Conservation Commission has determined the following (check whichever is applicable):

a. ☒ **Accurate**: The boundaries described on the referenced plan(s) above and in the Abbreviated Notice of Resource Area Delineation are accurately drawn for the following resource area(s):

1. ☒ Bordering Vegetated Wetlands
2. ☒ Other resource area(s), specifically:

a. Intermittant stream

b. ☒ **Modified**: The boundaries described on the plan(s) referenced above, as modified by the Conservation Commission from the plans contained in the Abbreviated Notice of Resource Area Delineation, are accurately drawn from the following resource area(s):

1. ☒ Bordering Vegetated Wetlands
2. ☐ Other resource area(s), specifically:

a. See ANRAD-Revisions attached

c. ☐ **Inaccurate**: The boundaries described on the referenced plan(s) and in the Abbreviated Notice of Resource Area Delineation were found to be inaccurate and cannot be confirmed for the following resource area(s):

1. ☐ Bordering Vegetated Wetlands
2. ☐ Other resource area(s), specifically:

Provided by MassDEP:

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 4B – Order of Resource Area Delineation

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

MassDEP File Number
252-0150
eDEP Transaction Number
Oakham
City/Town

B. Order of Delineation (cont.)

3. ☐ The boundaries were determined to be inaccurate because:

C. Findings

This Order of Resource Area Delineation determines that the boundaries of those resource areas noted above, have been delineated and approved by the Commission and are binding as to all decisions rendered pursuant to the Massachusetts Wetlands Protection Act (M.G.L. c.131, § 40) and its regulations (310 CMR 10.00). This Order does not, however, determine the boundaries of any resource area or Buffer Zone to any resource area not specifically noted above, regardless of whether such boundaries are contained on the plans attached to this Order or to the Abbreviated Notice of Resource Area Delineation.

This Order must be signed by a majority of the Conservation Commission. The Order must be sent by certified mail (return receipt requested) or hand delivered to the applicant. A copy also must be mailed or hand delivered at the same time to the appropriate DEP Regional Office (see http://www.mass.gov/eea/agencies/massdep/about/contacts/find-the-massdep-regional-office-for-your-city-or-town.html).

D. Appeals

The applicant, the owner, any person aggrieved by this Order, any owner of land abutting the land subject to this Order, or any ten residents of the city or town in which such land is located, are hereby notified of their right to request the appropriate DEP Regional Office to issue a Superseding Order of Resource Area Delineation. When requested to issue a Superseding Order of Resource Area Delineation, the Department's review is limited to the objections to the resource area delineation(s) stated in the appeal request. The request must be made by certified mail or hand delivery to the Department, with the appropriate filing fee and a completed Request for Departmental Action Fee Transmittal Form, as provided in 310 CMR 10.03(7) within ten business days from the date of issuance of this Order. A copy of the request shall at the same time be sent by certified mail or hand delivery to the Conservation Commission and to the applicant, if he/she is not the appellant.

Any appellants seeking to appeal the Department's Superseding Order of Resource Area Delineation will be required to demonstrate prior participation in the review of this project. Previous participation in the permit proceeding means the submission of written information to the Conservation Commission prior to the close of the public hearing, requesting a Superseding Order or Determination, or providing written information to the Department prior to issuance of a Superseding Order or Determination.

The request shall state clearly and concisely the objections to the Order which is being appealed and how the Order does not contribute to the protection of the interests identified in the Massachusetts Wetlands Protection Act, (M.G.L. c. 131, § 40) and is inconsistent with the wetlands regulations (310 CMR 10.00). To the extent that the Order is based on a municipal bylaw or ordinance, and not on the Massachusetts Wetlands Protection Act or regulations, the Department of Environmental Protection has no appellate jurisdiction.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 4B – Order of Resource Area Delineation

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

MassDEP File Number: 252-0150
eDEP Transaction Number:
City/Town: Oakham

E. Signatures

Date of Issuance: 12/3/24

Please indicate the number of members who will sign this form. 1. Number of Signers: 3

Signature of Conservation Commission Member

Signature of Conservation Commission Member

Signature of Conservation Commission Member

Signature of Conservation Commission Member

Signature of Conservation Commission Member

Signature of Conservation Commission Member

This Order is valid for three years from the date of issuance.

If this Order constitutes an Amended Order of Resource Area Delineation, this Order does not extend the issuance date of the original Final Order, which expires on 12/3/27 unless extended in writing by the issuing authority.

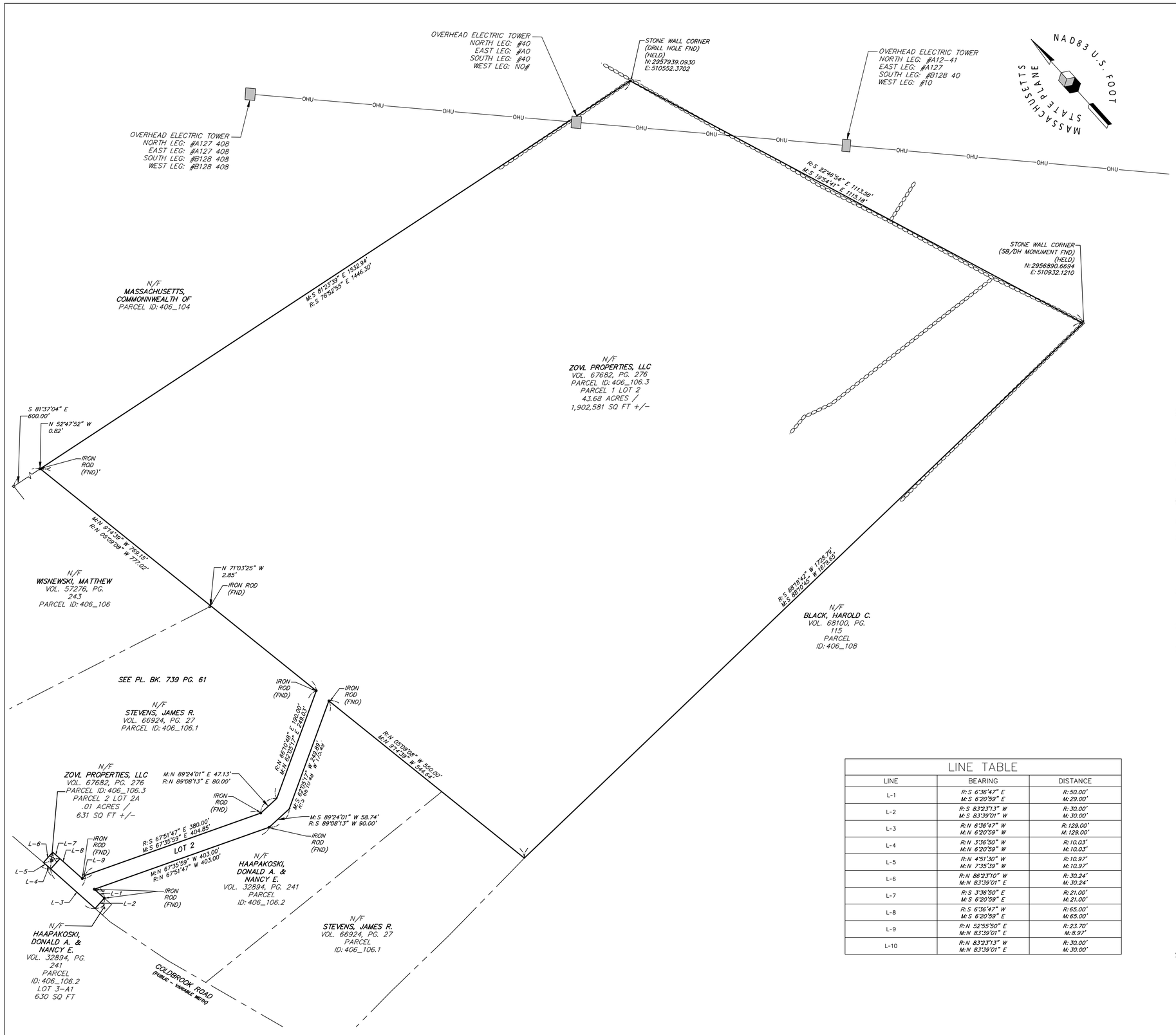
This Order is issued to the applicant and the property owner (if different) as follows:

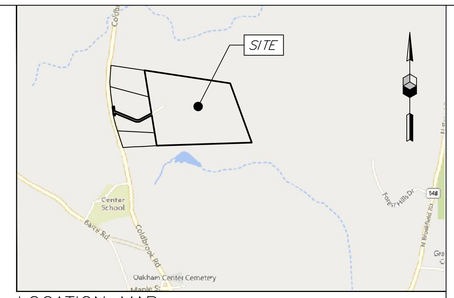
2. ☐ By hand delivery on

a. Date

3. ☑ By certified mail, return receipt requested on

a. Date: 12/4/24





LOCATION MAP
SCALE: NTS

LEGEND

- PROPERTY LINE
- EXISTING CONDITIONS AREA
- ABUTTER LINE
- MONUMENT FOUND
- DRILL HOLE/IRON ROD FOUND
- STONE WALL
- WETLANDS
- WETLANDS 100' BUFFER ZONE
- TREELINE
- 120 CONTOURS
- X120.00 SPOT GRADE
- OHU OVERHEAD UTILITY
- WETLAND FLAG
- ELECTRIC TOWER

WETLAND STATEMENT:

THE WETLAND BOUNDARIES AS SHOWN ON THE SURVEY WERE FLAGGED IN THE FIELD BY EPSILON ASSOCIATES AND SURVEYED BY CORNERSTONE ENERGY SERVICES, INC. ON 5/8/24 TO 5/17/24.

WETLAND BOUNDARIES SHOWN REFLECT ONLY THOSE FLAGGED IN THE FIELD AND DETERMINED NECESSARY FOR REVIEW OF THE PROJECT. ADDITIONAL WETLANDS MAY EXIST ELSEWHERE ON THE PROPERTY.

CERTIFICATION:

I HEREBY CERTIFY THAT THIS PLAN AND THE SURVEY ON WHICH IT WAS BASED WAS PREPARED IN ACCORDANCE WITH PROCEDURAL AND TECHNICAL STANDARDS FOR THE PRACTICE OF LAND SURVEYING IN THE COMMONWEALTH OF MASSACHUSETTS (250 CMR SEC. 6.00).

THIS PLAN SHOWS THE PROPERTY LINES THAT ARE THE LINES DIVIDING EXISTING OWNERSHIPS, AND THE LINES OF STREETS AND WAYS ARE THOSE OF PUBLIC OR PRIVATE STREETS OR WAYS ALREADY ESTABLISHED AND THAT NO NEW LINES FOR DIVISION OF EXISTING OWNERSHIP OR FOR NEW WAYS ARE SHOWN.

GLENN D. ODONE JR.
REGISTERED LAND SURVEYOR NO. 45068
COMMONWEALTH OF MASSACHUSETTS

COMMONWEALTH OF MASSACHUSETTS
GLENN D. ODONE JR.
No. 45068
REGISTERED LAND SURVEYOR

GENERAL NOTES:

1. THIS PLAN IS THE RESULT OF AN ON-THE-GROUND FIELD SURVEY COMPLETED BY CORNERSTONE ENERGY SERVICES, INC. IN MAY 2024.
2. BEARINGS SHOWN HEREON ARE REFERENCED TO GRID NORTH, MASSACHUSETTS STATE PLANE, NAD83. ELEVATIONS ARE IN REFERENCE TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) BASED ON DUAL FREQUENCY GPS OBSERVATIONS.
3. PROPERTY MAY BE SUBJECT TO RIGHTS AND EASEMENTS NOT SHOWN THAT MIGHT HAVE BEEN REVEALED BY A COMPLETE AND THOROUGH TITLE SEARCH.
4. UTILITY INFORMATION DEPICTED HEREON IS COMPILED USING PHYSICAL EVIDENCE LOCATED IN THE FIELD AT THE TIME OF THE SURVEY, AND IS A REPRESENTATION OF AVAILABLE SURFACE EVIDENCE ONLY, AND THEREFORE MAY NOT NECESSARILY DEPICT ALL EXISTING UTILITIES. CONTRACTORS AND/OR DESIGNERS NEED TO CONTACT DIG-SAFE SYSTEMS, INC, (1-888-DIG-SAFE) AND FIELD VERIFY EXISTING UTILITIES PRIOR TO ANY EXCAVATION.
5. REFERENCE IS MADE TO THE FOLLOWING DEEDS AND PLANS:
   - 5.1. DEED BOOK 67682 PAGE 276
   - 5.2. PLAN BOOK 575, PLAN 122 & PLAN BOOK 739 PLAN 61
6. THE BOUNDARY FORMATION SHOWN ON PLAN BOOK 575 PLAN 122 DID NOT MATCH THE PHYSICAL EVIDENCE FOUND IN THE FIELD. IT IS NOTED, THIS PLAN WAS COMPILED FROM DEEDS AND OTHER PLANS.

LINE TABLE

LINE	BEARING	DISTANCE
L-1	R:S 6°36'47" E M:S 6°20'59" E	R: 50.00' M: 29.00'
L-2	R:S 83°23'13" W M:S 83°39'01" W	R: 30.00' M: 30.00'
L-3	R:N 6°36'47" W M:N 6°20'59" W	R: 129.00' M: 129.00'
L-4	R:N 3°36'50" W M:N 6°20'59" W	R: 10.03' M: 10.03'
L-5	R:N 4°51'30" W M:N 7°35'39" W	R: 10.97' M: 10.97'
L-6	R:N 86°23'10" W M:N 83°39'01" E	R: 30.24' M: 30.24'
L-7	R:S 3°36'50" E M:S 6°20'59" E	R: 21.00' M: 21.00'
L-8	R:S 6°36'47" W M:S 6°20'59" E	R: 65.00' M: 65.00'
L-9	R:N 52°55'50" E M:N 83°39'01" E	R: 23.70' M: 8.97'
L-10	R:N 83°23'13" W M:N 83°39'01" E	R: 30.00' M: 30.00'

SEE SHEETS 2 & 3 FOR TOPOGRAPHIC DETAIL AND WETLANDS

100 50 0 100 200
SCALE: 1" = 100'

REV.:	BY:	DATE:	STATUS:
1	AR	05/23/24	ADDITIONAL TOPOGRAPHIC FEATURES
2	JEE	06/26/24	ADDITIONAL TOPOGRAPHIC FEATURES
3	DML	09/26/24	VISUAL UPDATES FOR CLARITY
4	DML	11/06/24	WETLAND FLAG CORRECTIONS AND VISUAL UPDATES FOR CLARITY

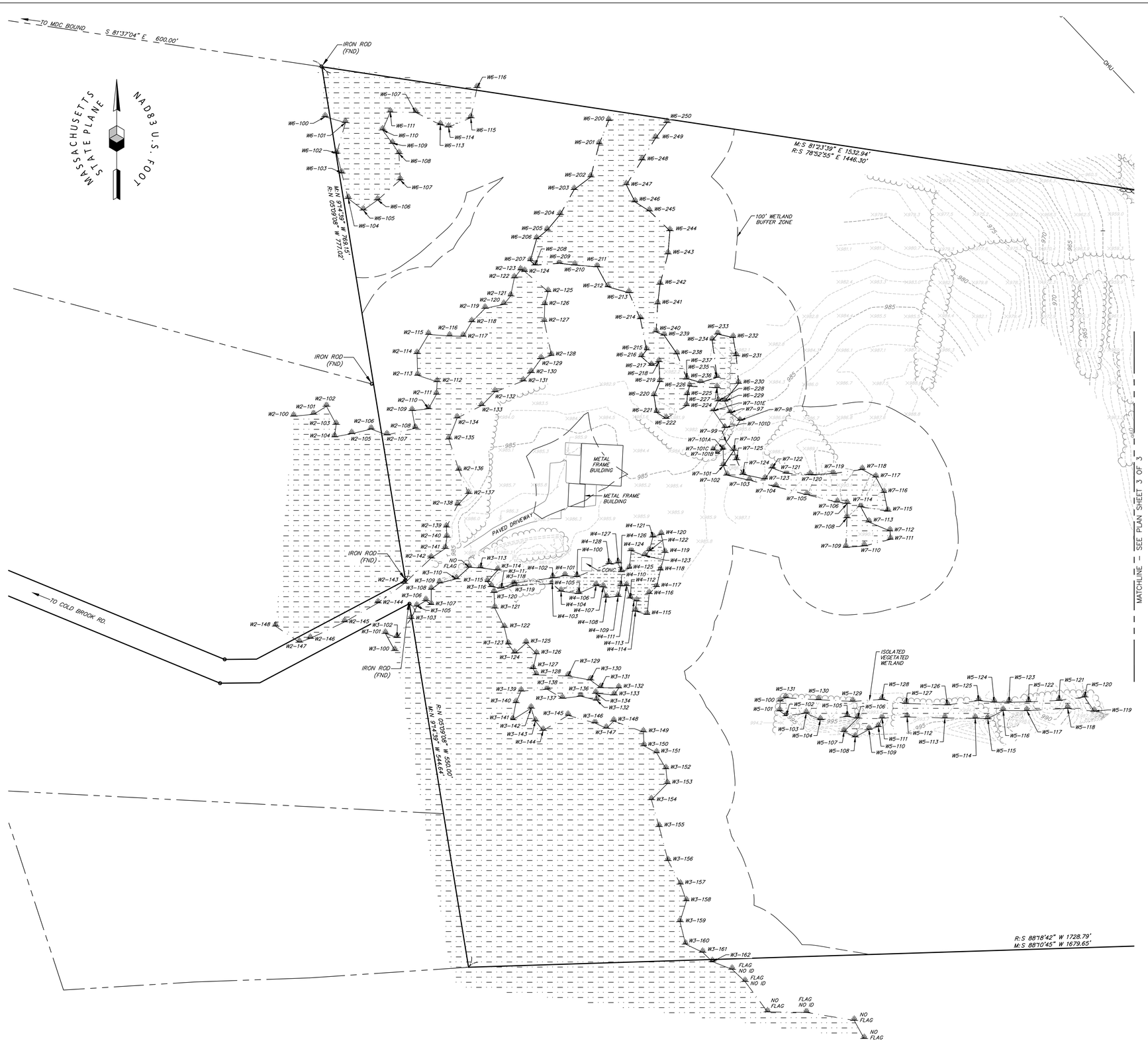
Cornerstone Energy Services
111 CHINQUAPIN ROUND ROAD
ANNAPOLIS, MD 21401
207-725-7340
FAX: 207-725-7343

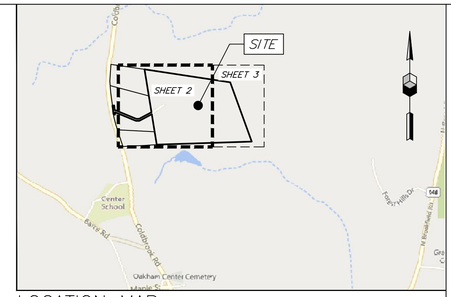
EXISTING CONDITIONS SURVEY
OF:
ZOVL PARCEL
358 Coldbrook Road
Oakham, MA 01068
FOR:
Rhynland Energy

RECORD OWNER:
ZOVL Properties, LLC

DRAWN	CHECKED
MA	DL
PROJECT NO.	DATE
23230.1	08/29/2023
SHEET SIZE	SCALE
24" x 36"	1" = 100'

SHEET 1 OF 3





LOCATION MAP
SCALE: NTS

LEGEND

- PROPERTY LINE
- EXISTING CONDITIONS AREA
- ABUTTER LINE
- MONUMENT FOUND
- DRILL HOLE/IRON ROD FOUND
- STONE WALL
- WETLANDS
- WETLANDS 100' BUFFER ZONE
- TREELINE
- 120 CONTOURS 120
- X 120.00 SPOT GRADE
- OHU OVERHEAD UTILITY
- WETLAND FLAG
- ELECTRIC TOWER

WETLAND STATEMENT:

THE WETLAND BOUNDARIES AS SHOWN ON THE SURVEY WERE FLAGGED IN THE FIELD BY EPSILON ASSOCIATES AND SURVEYED BY CORNERSTONE ENERGY SERVICES, INC. ON 5/8/24 TO 5/17/24.

WETLAND BOUNDARIES SHOWN REFLECT ONLY THOSE FLAGGED IN THE FIELD AND DETERMINED NECESSARY FOR REVIEW OF THE PROJECT. ADDITIONAL WETLANDS MAY EXIST ELSEWHERE ON THE PROPERTY.

CERTIFICATION:

I HEREBY CERTIFY THAT THIS PLAN AND THE SURVEY ON WHICH IT WAS BASED WAS PREPARED IN ACCORDANCE WITH PROCEDURAL AND TECHNICAL STANDARDS FOR THE PRACTICE OF LAND SURVEYING IN THE COMMONWEALTH OF MASSACHUSETTS (250 CMR SEC. 6.00).

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GLENN D. ODONE JR.
REGISTERED LAND SURVEYOR NO. 45068
COMMONWEALTH OF MASSACHUSETTS

COMMONWEALTH OF MASSACHUSETTS
GLENN D. ODONE JR.
No. 45068
REGISTERED LAND SURVEYOR

GENERAL NOTES:

1. THIS PLAN IS THE RESULT OF AN ON-THE-GROUND FIELD SURVEY COMPLETED BY CORNERSTONE ENERGY SERVICES, INC. IN MAY 2024.
2. BEARINGS SHOWN HEREON ARE REFERENCED TO GRID NORTH, MASSACHUSETTS STATE PLANE, NAD83. ELEVATIONS ARE IN REFERENCE TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) BASED ON DUAL FREQUENCY GPS OBSERVATIONS.
3. PROPERTY MAY BE SUBJECT TO RIGHTS AND EASEMENTS NOT SHOWN THAT MIGHT HAVE BEEN REVEALED BY A COMPLETE AND THOROUGH TITLE SEARCH.
4. UTILITY INFORMATION DEPICTED HEREON IS COMPILED USING PHYSICAL EVIDENCE LOCATED IN THE FIELD AT THE TIME OF THE SURVEY, AND IS A REPRESENTATION OF AVAILABLE SURFACE EVIDENCE ONLY, AND THEREFORE MAY NOT NECESSARILY DEPICT ALL EXISTING UTILITIES. CONTRACTORS AND/OR DESIGNERS NEED TO CONTACT DIG-SAFE SYSTEMS, INC, (1-888-DIG-SAFE) AND FIELD VERIFY EXISTING UTILITIES PRIOR TO ANY EXCAVATION.
5. REFERENCE IS MADE TO THE FOLLOWING DEEDS AND PLANS:
   - 5.1. DEED BOOK 67682 PAGE 276
   - 5.2. PLAN BOOK 575, PLAN 122 & PLAN BOOK 739 PLAN 61
6. THE BOUNDARY FORMATION SHOWN ON PLAN BOOK 575 PLAN 122 DID NOT MATCH THE PHYSICAL EVIDENCE FOUND IN THE FIELD. IT IS NOTED, THIS PLAN WAS COMPILED FROM DEEDS AND OTHER PLANS.

70 35.5 0 70 140
SCALE: 1" = 70'

REV.:	BY:	DATE:	STATUS:
4	DML	11/06/24	WETLAND FLAG CORRECTIONS AND VISUAL UPDATES FOR CLARITY
3	DML	09/26/24	VISUAL UPDATES FOR CLARITY
2	AR	06/26/24	ADDITIONAL TOPOGRAPHIC FEATURES
1	AR	05/23/24	ADDITIONAL TOPOGRAPHIC FEATURES

THIS PLAN SHALL NOT BE MODIFIED WITHOUT WRITTEN PERMISSION; ANY ALTERATIONS, AUTHORIZED OR OTHERWISE, SHALL BE AT THE USER'S SOLE RISK.

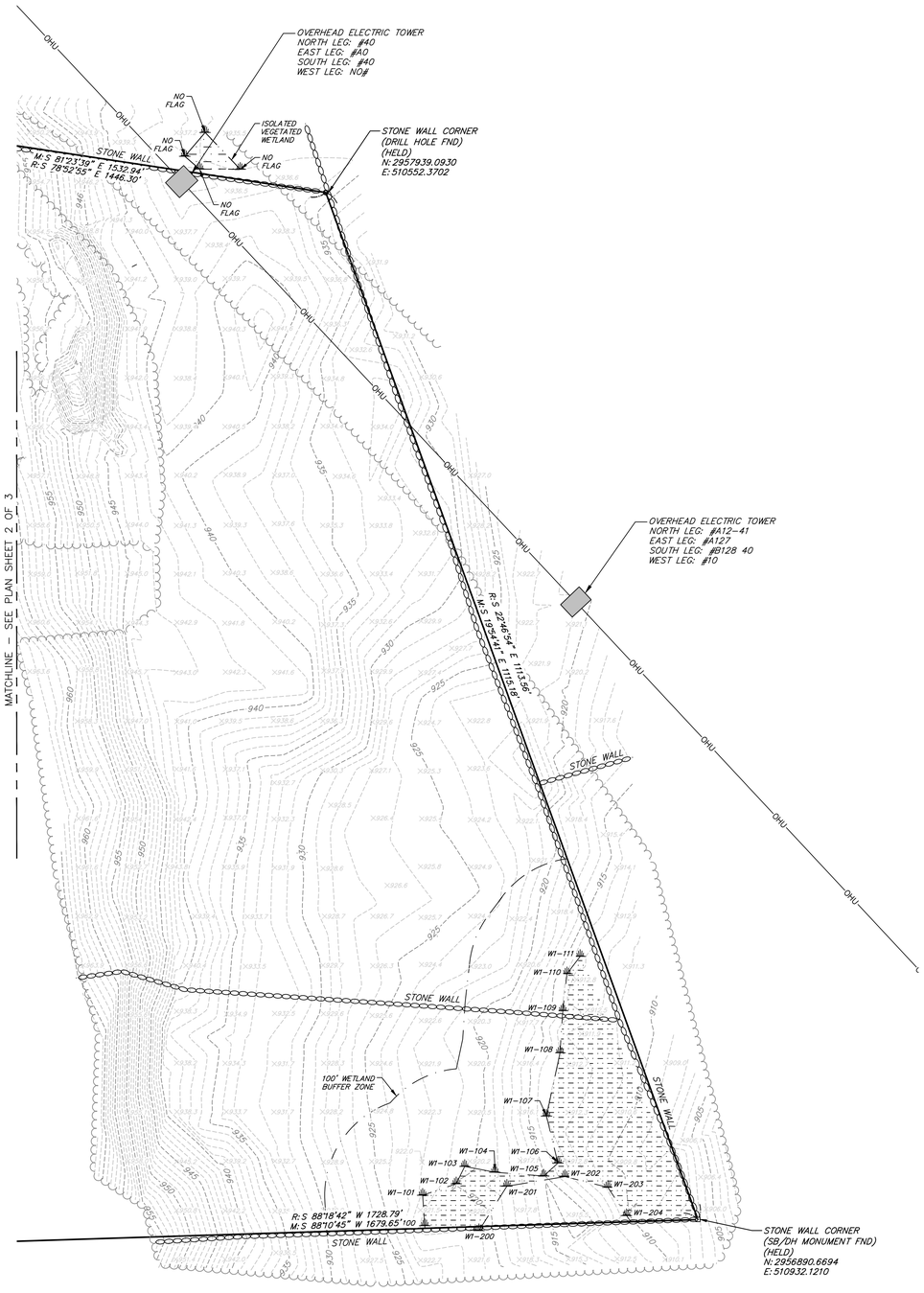
Cornerstone Energy Services
111 CHINQUAPIN ROUND ROAD
ANNAPOLIS, MD 21401
267-730-7340
FAX: 267-730-7343

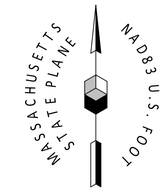
EXISTING CONDITIONS SURVEY
OF: ZOVL PARCEL
358 Coldbrook Road
Oakham, MA 01068
FOR: Rhynland Energy

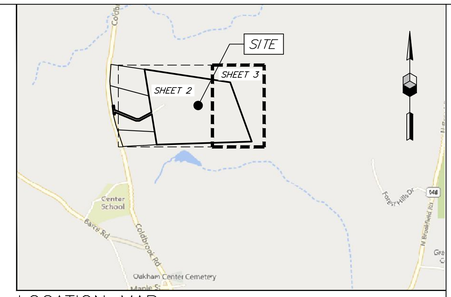
RECORD OWNER:
ZOVL Properties, LLC

DRAWN	CHECKED
MA	DL
PROJECT NO.	DATE
23230.1	08/29/2023
SHEET SIZE	SCALE
24" x 36"	1" = 70'

SHEET 2 OF 3







LOCATION MAP
SCALE: NTS

LEGEND

- PROPERTY LINE
- EXISTING CONDITIONS AREA
- ABUTTER LINE
- MONUMENT FOUND
- DRILL HOLE/IRON ROD FOUND
- STONE WALL
- WETLANDS
- WETLANDS 100' BUFFER ZONE
- TREELINE
- 120 CONTOURS 120
- X 120.00 SPOT GRADE
- OHU OVERHEAD UTILITY
- WETLAND FLAG
- ELECTRIC TOWER

WETLAND STATEMENT:

THE WETLAND BOUNDARIES AS SHOWN ON THE SURVEY WERE FLAGGED IN THE FIELD BY EPSILON ASSOCIATES AND SURVEYED BY CORNERSTONE ENERGY SERVICES, INC. ON 5/8/24 TO 5/17/24.

WETLAND BOUNDARIES SHOWN REFLECT ONLY THOSE FLAGGED IN THE FIELD AND DETERMINED NECESSARY FOR REVIEW OF THE PROJECT. ADDITIONAL WETLANDS MAY EXIST ELSEWHERE ON THE PROPERTY.

CERTIFICATION:

I HEREBY CERTIFY THAT THIS PLAN AND THE SURVEY ON WHICH IT WAS BASED WAS PREPARED IN ACCORDANCE WITH PROCEDURAL AND TECHNICAL STANDARDS FOR THE PRACTICE OF LAND SURVEYING IN THE COMMONWEALTH OF MASSACHUSETTS (250 CMR SEC. 6.00).

THIS PLAN SHOWS THE PROPERTY LINES THAT ARE THE LINES DIVIDING EXISTING OWNERSHIPS, AND THE LINES OF STREETS AND WAYS ARE THOSE OF PUBLIC OR PRIVATE STREETS OR WAYS ALREADY ESTABLISHED AND THAT NO NEW LINES FOR DIVISION OF EXISTING OWNERSHIP OR FOR NEW WAYS ARE SHOWN.

GLENN D. ODONE JR.
REGISTERED LAND SURVEYOR NO. 45068
COMMONWEALTH OF MASSACHUSETTS

COMMONWEALTH OF MASSACHUSETTS
GLENN D. ODONE JR.
No. 45068
REGISTERED LAND SURVEYOR

GENERAL NOTES:

1. THIS PLAN IS THE RESULT OF AN ON-THE-GROUND FIELD SURVEY COMPLETED BY CORNERSTONE ENERGY SERVICES, INC. IN MAY 2024.
2. BEARINGS SHOWN HEREON ARE REFERENCED TO GRID NORTH, MASSACHUSETTS STATE PLANE, NAD83. ELEVATIONS ARE IN REFERENCE TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) BASED ON DUAL FREQUENCY GPS OBSERVATIONS.
3. PROPERTY MAY BE SUBJECT TO RIGHTS AND EASEMENTS NOT SHOWN THAT MIGHT HAVE BEEN REVEALED BY A COMPLETE AND THOROUGH TITLE SEARCH.
4. UTILITY INFORMATION DEPICTED HEREON IS COMPILED USING PHYSICAL EVIDENCE LOCATED IN THE FIELD AT THE TIME OF THE SURVEY, AND IS A REPRESENTATION OF AVAILABLE SURFACE EVIDENCE ONLY, AND THEREFORE MAY NOT NECESSARILY DEPICT ALL EXISTING UTILITIES. CONTRACTORS AND/OR DESIGNERS NEED TO CONTACT DIG-SAFE SYSTEMS, INC, (1-888-DIG-SAFE) AND FIELD VERIFY EXISTING UTILITIES PRIOR TO ANY EXCAVATION.
5. REFERENCE IS MADE TO THE FOLLOWING DEEDS AND PLANS:
   - 5.1. DEED BOOK 67682 PAGE 276
   - 5.2. PLAN BOOK 575, PLAN 122 & PLAN BOOK 739 PLAN 61
6. THE BOUNDARY FORMATION SHOWN ON PLAN BOOK 575 PLAN 122 DID NOT MATCH THE PHYSICAL EVIDENCE FOUND IN THE FIELD. IT IS NOTED, THIS PLAN WAS COMPILED FROM DEEDS AND OTHER PLANS.

70 35.5 0 70 140
SCALE: 1" = 70'

REV.:	BY:	DATE:	STATUS:
1	AR	05/23/24	ADDITIONAL TOPOGRAPHIC FEATURES
2	JEE	06/26/24	ADDITIONAL TOPOGRAPHIC FEATURES
3	DML	08/26/24	VISUAL UPDATES FOR CLARITY
4	DML	11/06/24	WETLAND FLAG CORRECTIONS AND VISUAL UPDATES FOR CLARITY

Cornerstone Energy Services
111 CHINQUAPIN ROUND ROAD
ANNAPOLIS, MD 21401
207-730-7340
FAX: 207-730-7343

EXISTING CONDITIONS SURVEY
OF:
ZOVL PARCEL
358 Coldbrook Road
Oakham, MA 01068
FOR:
Rhyland Energy

RECORD OWNER:
ZOVL Properties, LLC

DRAWN	CHECKED
MA	DL
PROJECT NO.	DATE
23230.1	08/29/2023
SHEET SIZE	SCALE
24" x 36"	1" = 70'

SHEET 3 OF 3

Attachment F

Site Photographs

Photograph 1: View of W-4 Series BVW, south of the existing access road.

Photograph 2: View of swale on the west end of the W-4 series BVW, looking west where it connects to the W3-Series BVW.

Photograph 3: View of certified vernal pool #8769.

Photograph 4: View of certified vernal pool #8768.

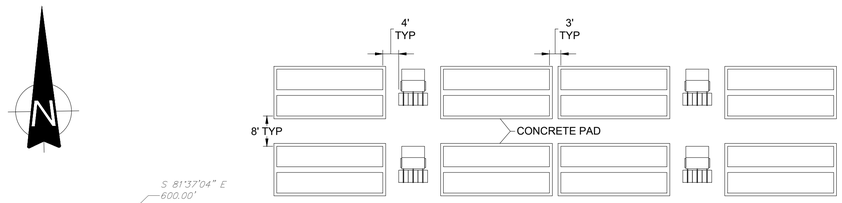
Photograph 5: Photo of Peg Mill Pond, looking south from property boundary of 358 Cold Brook Road.

Photograph 6: View of certified vernal pool #8768.

Attachment G

Permit Drawings prepared by ARUP

PLOT TIME: 5/12/2026 11:36 AM
PLOT BY: Reese Smith



BESS CLEARANCE TYPICAL
SCALE: 1" = 20'

GENERAL NOTES

1. TOPOGRAPHIC/SITE SURVEY, WETLAND LOCATIONS AND INFORMATION, AND LOCATIONS OF UNDERGROUND UTILITIES SOURCED FROM "EXISTING CONDITIONS SURVEY OF: ZOVL PARCEL" BY CORNERSTONE SURVEY COMPLETED IN MAY 2024 AND MARCH 2025.
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4. NOISE WALL SOUND PARAMETERS AND HEIGHT TO BE BY OTHERS. FOUNDATION AND FOOTING DESIGN TO BE PROVIDED BY CIVIL EOR DURING DETAILED DESIGN.
5. THE FEASIBILITY OF REPLACING THE PROPOSED CATCH BASINS AND DRAINAGE PIPES INDICATED ALONG THE DRIVEWAY ON THIS PLAN WITH LOW IMPACT DEVELOPMENT (LID) STRATEGIES SUCH AS DRAINAGE CONVEYANCE SWALES WILL BE ASSESSED DURING SUBSEQUENT DESIGN PHASES. ANY SUCH LID STRATEGIES WILL BE DESIGNED TO AVOID CONSTRUCTION ACTIVITIES WITHIN THE 100' WETLAND BUFFER, AND TO CONFORM WITH THE MASSACHUSETTS DEP STORMWATER STANDARDS.

Issue	Date	Revisions
A	9/22/23	DRAFT ISSUED FOR REVIEW
B	9/28/23	CONSTRAINT MAPPING
C	8/21/24	10% DESIGN SUBMISSION
D	9/13/24	30% DESIGN DRAFT
E	11/01/24	ISSUED FOR ISO-NE SIS APPLICATION
F	02/28/2025	30% DESIGN
G	03/18/2025	30% DESIGN REVISION
H	11/14/2025	SITE PLAN ALTERNATIVE
I	12/16/2025	SITE PLAN ALTERNATIVE
J	05/12/2026	PERMIT SET

ARUP

60 State Street , Boston, MA
02109, United States

www.arup.com

Client
MORAGA STORAGE LLC

Job Title
MORAGA STORAGE
ZOVL - Oakham, MA

Seal
B DEREK ANDERSON
CIVIL
NO. 47355
5/12/2026
REGISTERED PROFESSIONAL ENGINEER
COMMONWEALTH OF MASSACHUSETTS

NOT FOR CONSTRUCTION

Drawing Title
CIVIL SITE PLAN

Scale
1" = 100'

File Name
C2-01 - VERNAL POOL ALTERNATE.V3.DWG

Drawing Status
30% DESIGN DRAWINGS

Job No	Drawing No	Issue
296229-00	C2-01	I

PLOT TIME: 5/12/2026 11:34 AM
PLOT BY: Reese Smith

GENERAL NOTES

1. TOPOGRAPHIC/SITE SURVEY, WETLAND LOCATIONS AND INFORMATION, AND LOCATIONS OF UNDERGROUND UTILITIES SOURCED FROM "EXISTING CONDITIONS SURVEY OF: ZOVL PARCEL" BY CORNERSTONE SURVEY COMPLETED IN MAY 2024 AND MARCH 2025.
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J	05/12/2026	PERMIT SET

ARUP

60 State Street , Boston, MA
02109, United States

www.arup.com

Client
MORAGA STORAGE LLC

Job Title
MORAGA STORAGE
ZOVL - Oakham, MA

Seal
B. DEREK ANDERSON
COMMONWEALTH OF MASSACHUSETTS
CIVIL
NO. 47558
5/12/2026
REGISTERED PROFESSIONAL ENGINEER

NOT FOR CONSTRUCTION

Drawing Title
CIVIL SITE PLAN

Scale
1" = 50'

File Name
C2-01 - VERNAL POOL ALTERNATE.V3.DWG

Drawing Status
30% DESIGN DRAWINGS

Job No	Drawing No	Issue
296229-00	C2-02	I

50 0 50 100

Attachment H

Stormwater Report prepared by ARUP

ARUP

Rhynland Energy

Moraga Storage LLC - ZOVL (Oakham, MA)

Stormwater Management Report

Revision 2 | December 16, 2025

Job number 296229-00

Arup US, Inc.
60 State Street
Boston, MA 02109
USA
arup.com

Contents

Tables

Figures

Appendices

1. Introduction

1.1 General Information

- **Project Address:** 358 Coldbrook Rd Oakham, MA 01068
- **Existing Land Use/Zoning:** Agricultural and Rural Residential District
- **Applicant Name:** Rhynland Energy
  - **Applicant Contact:** Gus Hadidi
  - **Address:** 750 Lexington Avenue, 9th Floor New York, NY 10022
  - **Email:** ghadidi@rhynland.com
  - **Phone:** (401) 215-4000
- **Engineer of Record:** Derek Anderson
  - **Address:** 60 State St, Boston MA 02109 USA
  - **Email:** derek.anderson@arup.com
  - **Phone:** (614) 864-2987

1.2 Executive Summary

This Stormwater Management Report was prepared in accordance with the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Handbook on behalf of Rhynland Energy. The report examines the changes in drainage that can be expected as the result of the proposed battery energy storage site (BESS) development located at 358 Coldbrook Road in the Town of Oakham in Worcester County, Massachusetts (herein referred to as the 'Site').

Figure 1-1: Site Locus Map

The proposed project consists of 74 battery units with associated utility connections, and site improvements including electrical equipment, concrete pads, access driveways, and stormwater drainage infrastructure.

The stormwater management system for this site has been designed utilizing Best Management Practices (BMPs) and Low Impact Design (LID) to be in general compliance with the stormwater management standards outlined in the Massachusetts Stormwater Handbook. The proposed project will provide pollutant reduction by way of proprietary stormwater treatment devices, and peak runoff attenuation by way of reducing impervious coverage, maintaining existing drainage patterns, and the implementation of dry detention basins. The project will also provide erosion and sedimentation control drawings in accordance with the Erosion and Sedimentation Guidelines: A Guide for Planners, Designers, and Municipal Officials during the demolition and construction periods, as well as long term stabilization of the site.

Peak runoff to the Site's design points have been reduced in the post development conditions. A summary of the pre- and post-development conditions peak runoff rates for the 2-, 10-, and 100-year are shown in **Table 1-1** below.

The design detailed in this report is further supported by the site development drawings prepared by Arup dated March 18th, 2025, provided in **Appendix M**.

Table 1-1: Peak Runoff Rate Summary (cfs)

	2-year			10-year			100-year		
	Pre	**Post**	**Δ**	**Pre**	**Post**	**Δ**	**Pre**	**Post**	**Δ**
DP-1	8.51	5.10	-3.41	15.58	8.81	-6.77	27.16	16.35	-10.81
DP-2	13.60	10.99	-2.61	25.27	23.37	-1.9	44.43	43.24	-1.19

2. Site Conditions

2.1 Existing Site Description

The existing parcel is approximately 42.85 acres and the proposed limit of disturbance is 17.9 acres. The entire Town of Oakham is designated as an "Agricultural and Rural Residential District" as indicated on the "Zoning Map of Oakham, Massachusetts" prepared in March 1972. The site is bordered to the east by Coldbrook Road, and to the north, south, and west by rural, vegetated land.

The site is the location of a former automobile salvage storage facility that today is comprised mostly of forest, marsh, and unmaintained developed area. Additionally, a Massachusetts Electric d/b/a National Grid maintained power line easement passes through the northeastern portion of the site. A paved road provides access to the Site from Coldbrook Road. At the end of the access road there is an abandoned one-story, two bay service garage, an attached one-story office or reception building, and a separate shed. Much of the site is covered by unpaved access roads and former car storage areas which are becoming overgrown with shrubs and herbaceous vegetation.

The western portion of the Site is generally level, but includes small manmade drainage channels, mounds, depressions, and berms. In the northeast portion, the topography gradually slopes down in a northeasterly direction. In the southeast portion, there is a steep decline that becomes shallower going eastward.

2.1.1 Soil Conditions

According to the USDA Natural Resources Conservation Service (NRCS) Web Soil Survey, the main soil types onsite are hydrologic soil group (HSG) types C and D. See **Table 2-1** for all soil types onsite and their corresponding hydrologic soil group per Web Soil Survey (see **Appendix C**).

During our initial screening of the site, it was determined that the groundwater elevation has a depth of about 19-27" below grade per the USDA Web Soil Survey. Per the Massachusetts Stormwater Handbook, a vertical separation of 2' is required between groundwater and the bottom of our stormwater system. Furthermore, since the site is comprised mostly of C and D soils - infiltration on the Site was deemed not suitable. The design will instead implement surface detention basins with impermeable liners to accommodate the peak flow mitigation requirements.

Table 2-1: NRCS Soil Survey

Map Unit Symbol	Map Unit Name	Rating	HSG
910C	Woodbridge-Paxton association, 3 to 15 percent slopes, extremely stony	Moderately well drained	C/D
918B	Ridgebury-Whitman association, 0 to 8 percent slopes, extremely stony	Poorly drained	D
927C	Montauk-Scituate-Canton association, 3 to 15 percent slopes, extremely stony	Well drained	C

2.1.2 Wetland Information

The Site contains multiple wetland resource areas, primarily classified as Bordering Vegetated Wetlands (BVWs). The site contains 6,600 linear feet of BVW per field delineation by Epsilon on July 21, 2023 and March 26, 2024 and approved by the Oakham Conservation Commission through an Order of Resource Area Delineation (ORAD) in December 2024.

The proposed development aims to limit the amount of disturbance to these existing wetland systems to the maximum extent feasible. Under the Massachusetts Wetland Protection Act (WPA), a BVW has a 100-foot Buffer Zone extending from its edge - project work within the 100-foot Buffer Zone includes: grading, stormwater drainage infrastructure, battery and associated utility installation, paved access roadway, gravel walkways, and a proposed noise wall. The WPA does not have strict performance standards for buffer zone work, and the Town of Oakham does not have a wetlands protection bylaw or wetland delineation methodology that differs from the state methodology – therefore, no additional mitigation is required for work within this buffer zone.

Practical alternatives were explored to avoid direct BVW impact, but in order to access the rear of the site – a proposed access road crossing in the area of BVW Flag Series W6 & W7 was determined to be necessary. This disturbance totals to approximately 800 SF of temporary disturbance and 385 SF of permanent wetland fill. Per the WPA, work proposed directly within a BVW must meet specific performance standards as outlined in 310 CMR 10.55 and 310 CMR 10.53(1). The permanent alteration will be replaced at a 1:1 or greater ratio in area and function and be hydrologically connected to the original BVW, maintain similar or improved wetland functions, and use native plantings and appropriate soil conditions.

Additionally, while Isolated Vegetated Wetlands (IVWs) are present, they do not meet the criteria for Isolated Land Subject to Flooding (ILSF) under the WPA. Nevertheless, no work is proposed in these areas.

Indirect impacts from stormwater discharges will be mitigated through the use of sedimentation and erosion control measures during construction as well as BMPs and an Operation & Maintenance Plan once the site is fully constructed and stabilized.

Supplemental information regarding the existing wetlands is provided in **Appendix L**.

2.1.3 Environmental Concerns

According to the most current mapping on MassGIS, there are no Areas of Critical Environmental Concern (ACEC), Outstanding Resource Water (ORW), or Environmental Communities/Populations mapped within the Site. Additionally, there are no mapped Priority and Estimated Habitats, nor any Vernal pools located on the Site.

The western portion of the site is located within Zone A, Zone B, and Zone C of the Surface Water Supply Protection Area. The proposed project includes access roadway improvements within the Zone C area; however, no stormwater discharges are proposed in the overlay areas. All stormwater from the improved roadway areas will be managed in accordance with the MassDEP Stormwater Standards, ensuring that runoff is directed to appropriate treatment and discharge locations outside of the protection areas. As no new stormwater discharges are occurring within the protection areas, the project does not impact water quality or require additional stormwater mitigation measures for that area.

2.1.4 FEMA Flood Zones

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM), map number 2503240005B, effective April 3, 1984, the site is not located in a FEMA floodplain. See **Appendix B**.

2.2 Proposed Site Description

The proposed project consists of 74 battery units with associated utility connections, and site improvements including electrical equipment, concrete pads, access driveways, and stormwater drainage infrastructure. The site has been designed to maintain existing topography and mimic existing drainage patterns to the maximum extent feasible.

The only impervious surfaces proposed to be constructed are access roads and small concrete pads for utility equipment. Once operational, vehicular access to the project will be limited to infrequent maintenance visits. The proposed improvements will result in 117,065 SF of impervious area. A total of approximately 778,380 square feet or 17.9 acres of disturbed area is anticipated, including lay-down and staging areas, and construction activities associated with the project. All work will take place within the proposed property limits. The impervious surfaces defined above will be kept to the minimum practical. This design gives preference to proposed drainage infrastructure, low impact development, and maintains existing grade, as much as practical.

BESS sites are complicated in nature due to their intricate ownership structures, phased construction processes, and need for extensive coordination with local utilities and regulatory authorities. Specifically for this site, additional information will be provided at future phases of design once a contractor has been procured and local utility owners have been engaged. Due to these complexities, the project will provide construction period pollution prevention plans and erosion and sedimentation control plans, long-term pollution prevention plans, and identification of post-construction drainage system owners and parties responsible for O&M in a subsequent design phase.

3. Stormwater Management

3.1 Design Criteria & Stormwater Methodology

To strengthen community resilience and prepare for the impacts of climate change, the Massachusetts Environmental Policy Act (MEPA) Interim Protocol has been established. This protocol includes the efforts of the Resilient Massachusetts Action Team (RMAT), which is advancing the "Climate Resilience Design Standards and Guidelines" project. The design standards for extreme precipitation incorporate an increase factor based on the project's design life. A percent increase is applied to the National Oceanic and Atmospheric Administration (NOAA) medial values. The project has a design life of approximately 20 years which follows the Mid-Century precent increases. All values are listed in

Table 3-1 below and NOAA rainfall data can be found in **Appendix K**.

Table 3-1: Rainfall Depths

Frequency (24-hr Duration)	2-year	10-year	25-year	100-year
NOAA Atlas 14 Present Baseline 24hr Rainfall (inches)	3.06	4.74	5.79	7.41
Mid-Century (2030/2050) (in)	3.9	6.0	7.4	9.4

The peak runoff discharges for existing and proposed conditions were analyzed using the Soil Conservation Service (SCS) methodology. Values for area, curve number and time of concentration were calculated for existing and proposed conditions. Values of time of concentration (Tc) were determined for existing and proposed conditions based on land cover and slope of the flow path, using methods outlined in the SCS methodology. The minimum Tc used in TR-55 is 0.1 hour. For this study, a 24-hour SCS Type III standard rainfall was used to determine the peak flow rate to the point of discharge from the site. The pre- and post-development runoff rates discharged from the site were ultimately computed using the Autodesk Stormwater & Sanitary Analysis (SSA) computer program.

Water Quality Volume ("WQV") for the site will be calculated assuming that the concrete equipment pads are impervious cover and gravel surfaces are pervious cover.

3.2 Existing Conditions

3.2.1 Existing Development Collection and Conveyance

The existing condition did not include any drainage infrastructure. Stormwater flows predominantly from west to east and north to south across the site via overland flow.

The project site is split between the Ware and the Quaboag sub-watersheds within the larger Chicopee watershed.

The portion of the site that drains to DP-2 is within the Quaboag River sub-watershed. The Quaboag River originates at Quaboag Pond and flows through the towns of Brookfield, West Brookfield, and Warren, Massachusetts. As Quaboag Pond has an established Total Maximum Daily Load (TMDL) for phosphorus,

developments and stormwater discharges within its watershed are subject to a 30% total phosphorus loading removal requirement to address issues like algal blooms and excessive aquatic plant growth.

3.2.2 Existing Watersheds and Design Point Information

The pre-development drainage conditions were delineated into two (2) sub-catchment areas that drain to two (2) design points:

- Design Point 1 (DP-1): Sub-catchment E1
- Design Point 2 (DP-2): Sub-catchment E2

The entire site is part of the larger Chicopee River Watershed, but the site is split between two sub-watersheds. Sub-catchment E1 drains to DP-1, which is part of the Ware River sub-watershed. Sub-catchment E2 drains to DP-2, which is part of the Quaboag River sub-watershed.

Refer to the Pre-Development Conditions Watershed Map in **Appendix D** for a depiction of the pre-development watersheds, flow paths, and design points for the site.

Table 3-2 below illustrates the calculated pre-development conditions peak rates of runoff.

Table 3-2: Existing Conditions Peak Runoff Rates (cfs)

Point of Analysis	2-Year Storm	10-Year Storm	100-Year Storm
DP-1	8.51	15.58	27.16
DP-2	13.60	25.27	44.43

3.3 Proposed Conditions

3.3.1 Proposed Development Collection and Conveyance

Natural drainage patterns will be maintained throughout the site to the maximum extent practicable so that the proposed hydrologic conditions will closely match existing conditions.

Drainage catchment areas and stormwater calculations presented herein are based on the 30% Site Civil Plans and represent a conceptual design intended to demonstrate engineering feasibility and regulatory compliance. As site grading and BMP selection are refined during subsequent design phases, drainage catchment boundaries and stormwater calculations will be updated accordingly. This iterative process is consistent with standard engineering practice and does not alter the project's commitment to full compliance with the Massachusetts Stormwater Management Standards and applicable watershed-specific requirements.

The site has been designed with a conventional drainage system. The site's impervious runoff is directed to a series of catch basins and manholes which capture and convey stormwater runoff via underground pipe system which is conveyed to two (2) proposed proprietary treatment devices for pre-treatment. In order to meet the TMDL requirement noted in **Section 3.2.1**, the project is proposing the use of two (2) proprietary Jellyfish filters downstream of the pre-treatment devices. These devices will be appropriately sized by the manufacturer to achieve the required phosphorus reduction. Additionally, these units have been sized by the manufacturer to avoid scouring of sediment and oils in the device during the 100-year storm. Supporting documentation demonstrating compliance with the relevant treatment requirements is provided in **Appendix F**.

The majority of the Site's flows discharge to two (2) dry detention basins upstream of their respective design points in order to capture and attenuate peak flows prior to discharge. See **Section 3.4** for additional information on how the project meets the Massachusetts Stormwater Standards.

A noted, the proposed dry detention basins have been designed without an infiltration component due to high groundwater levels and the presence of low-permeability soils. To prevent infiltration and ensure long-term stability, these basins will include an impermeable liner. Given the high groundwater conditions, buoyancy of the liner may be a concern. During the detailed design phase, buoyancy calculations will be conducted to assess potential uplift forces. If necessary, anchoring or other stabilization measures will be incorporated into the final design to prevent displacement and ensure long-term performance.

The proposed subsurface storm drainage collection system is designed to convey at minimum the 25-year design storm event throughout the site. Storm drainage pipes were sized based on calculated design flows using the Autodesk Storm and Sanitary Analysis with the TR-20 methodology.

3.3.2 Proposed Watersheds and Design Point Information

The proposed conditions drainage patterns maintain the same design points as existing, but are broken into four (4) sub-catchments:

- Design Point 1 (DP-1): Sub-catchments P1 and P2
  - Runoff from sub-catchments P1 and P2 is treated by the proposed water quality unit/hydrodynamic separator and Jellyfish Filter before being released to the proposed dry detention basin (Pond1) for attenuation prior to discharge.

- Design Point 2 (DP-2): Sub-catchments P3 and P4
  - Sub-catchment P3 contains no impervious area. Runoff from this area flows directly to DP-2 via a stormwater conveyance channel. While no attenuation or treatment is provided for these flows, they are still included in the peak flow analysis.
  - Runoff from sub-catchment P4 is treated by a proposed water quality unit/hydrodynamic separator and a Jellyfish Filter before being released to the proposed dry detention basin (Pond2) for attenuation prior to discharge.

Refer to the Post-Development Conditions Watershed Map in **Appendix D** for a depiction of the post-development watersheds, flow paths, and design points for the site.

Table 3-3 below illustrates the calculated post-development conditions peak rates of runoff.

Table 3-3: Proposed Conditions Peak Runoff Rates (cfs)

Point of Analysis	2-Year Storm	10-Year Storm	100-Year Storm
DP-1	5.10	8.81	16.35
DP-2	10.99	23.37	43.24

3.3.3 Gravel Access Road Drainage System

The 12/16/2025 Site Plan Alternative plan proposes a gravel access road intended to support construction and long-term O&M of the facility. The access road is located outside the fenced Battery Energy Storage System (BESS) facility and is not intended to function as an impervious surface. At the 30% design stage, the gravel access road is treated as a pervious surface for stormwater management purposes. Runoff from the access road will be managed using Best Management Practice (BMP)-based conveyance, including a crowned road section with vegetated and/or stone-lined swales to promote infiltration, sediment attenuation, and non-erosive flow conveyance. Catch basins and piped drainage elements shown along the access road on the 30% site plans are conceptual placeholders only, included to demonstrate potential low-point control and continuity of drainage. During subsequent design phases, these structures are expected to be replaced in whole or in part with swales and other non-structural BMPs, subject to final grading and detailed drainage analysis. The access road drainage system is intended to function independently from the BESS facility stormwater basins, except where localized

conditions necessitate controlled discharge for stability or regulatory compliance. Final drainage configuration will be confirmed during detailed design.

3.4 Stormwater Management Standards

In accordance with the Massachusetts Stormwater Handbook, the following stormwater management standards are provided. The proposed stormwater management system has been designed to comply with the currently approved Massachusetts Stormwater Standards as outlined in the MassDEP Stormwater Handbook. It is acknowledged that proposed revisions to the Stormwater Standards are under review but have not yet been formally adopted. While these updates are not yet enforceable, the design has incorporated aspects of the proposed changes where feasible to align with anticipated future requirements. If the updated Stormwater Standards are adopted prior to project approval, a review of the final approved regulations against the current design will be conducted to determine any necessary modifications to ensure compliance.

Stormwater runoff from impervious areas within the fenced BESS facility will be collected, treated, and managed in accordance with applicable Stormwater Standards, including peak flow attenuation and water quality treatment. The stormwater management system has been designed to ensure no adverse impacts to downstream resources and to maintain pre-development hydrologic conditions to the maximum extent practicable. The gravel access road proposed in the 12/16/2025 Site Plan Alternative plan does not require treatment for Total Suspended Solids (TSS) under the Stormwater Handbook; however, erosion control, stabilization, and non-erosive conveyance are incorporated into the design through BMP-based drainage measures.

3.4.1 Standard 1 – No New Untreated Discharge

The Massachusetts Stormwater Handbook states that no new stormwater conveyances may discharge untreated stormwater directly to or cause erosions in wetlands or waters of the Commonwealth. The project treats all stormwater runoff from impervious areas via proprietary treatment devices on-site prior to discharge.

Additionally, to prevent erosion and sedimentation, BMPs and associated pipes and other conveyances must be properly designed and installed in accordance with Volume 2 of the Massachusetts Stormwater Handbook. A downstream analysis has been completed to confirm that the proposed outfalls are non-erosive.

3.4.2 Standard 2 – Peak Rate Attenuation

The Massachusetts Stormwater Handbook states that stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. The proposed development discharge rates are below the existing rates. A summary of the existing and proposed discharge rates has been listed in **Section 3.3** of this report and Autodesk Storm and Sanitary outputs can be found in **Appendix I**.

Two (2) surface detention basins with impermeable liners will be implemented to accommodate the peak flow mitigation requirements The detention basins will completely drain within 48 hours after the end of a storm. Sizing calculations are shown in **Appendix H**.

3.4.3 Standard 3 – Recharge

Due to potentially high groundwater conditions and site soil conditions as noted in **Section 2.1.1**, groundwater recharge was deemed as not feasible as the systems will not be able to achieve adequate separation from groundwater. However, opportunity for groundwater recharge is provided through the landscaped areas on site.

3.4.4 Standard 4 –Water Quality

The required water quality volume equals 1.0 inch of runoff times the total impervious area of the post-development project site for a discharge. As noted in **Sections 2.1.1** and **3.4.3**, infiltration was deemed not feasible on this site, therefore stormwater quality will be improved through the proposed water quality units and ultimately long-term operation and maintenance plans. The proprietary water quality units will capture and treat

runoff from the impervious surfaces prior to discharge.These units have been sized by the manufacturer to avoid scouring of sediment and oils in the device during the 100-year storm.

As noted in **Section 3.2.1**, there is an established Total Maximum Daily Load (TMDL) for phosphorus, so stormwater discharges within the Quaboag sub-watershed are subject to a 30% total phosphorus removal requirement. To meet this standard at the current 30% design stage, phosphorus removal within the Quaboag drainage area is addressed conceptually through a combination of:

1. Vegetated and/or stone-lined swales providing soil contact and infiltration
2. Distributed BMP-based treatment along drainage flow paths
3. Structural treatment measures (e.g., proprietary Jellyfish Filter filtration systems) where required to supplement non-structural BMP performance

The proposed treatment devices have been sized to meet the required water quality flow (QWf) and bypass flows from greater storm events. See **Appendix F** for water quality calculations and supporting documentation from the manufacturer. Final phosphorus load calculations, BMP sizing, and allocation between structural and non-structural controls will be completed during detailed design once final grading and drainage catchment areas are established.

The Massachusetts Stormwater Handbook also requires systems to be designed to remove 80% of the average annual post-development Total Suspended Solids (TSS). According to the automated calculations, the proposed treatment train results in 96% TSS removal across the Site. The TSS removal calculations were completed using the automated Excel spreadsheet from the MassDEP website. TSS removal calculations and material from the manufacturer is included in **Appendix G**.

3.4.5 Standard 5 – Land Uses with Higher Potential Pollutant Loads (LUHPPLs)

This proposed battery storage facility is not considered a Land Use with Higher Potential Pollutant Loads. Therefore, Standard 5 does not apply.

3.4.6 Standard 6 – Critical Areas

There are no Areas of Critical Environmental Concern located on the project site.

As noted in **Section 2.1.3**, the western portion of the site is located within Zone A, Zone B, and Zone C of the Surface Water Supply Protection Area. The proposed project includes access roadway improvements within the Zone C area; however, no stormwater discharges are proposed in the overlay areas. All stormwater from the improved roadway areas will be managed in accordance with the MassDEP Stormwater Standards, ensuring that runoff is directed to appropriate treatment and discharge locations outside of the protection areas. As no new stormwater discharges are occurring within the protection areas, the project does not impact water quality or require additional stormwater mitigation measures for that area. Regardless, the stormwater management system for this project is still designed for the more stringent the 1-inch runoff depth for the calculated water quality treatment volume.

3.4.7 Standard 7 – Redevelopment

The Site is not considered a redevelopment or infill project so Standard 6 does not apply.

3.4.8 Standard 8 – Construction Period Pollution Prevention and Erosion and Sedimentation Control

The project has provided erosion and sedimentation control drawings for the demolition and construction periods and will provide a separate report regarding long term stabilization of the site at a subsequent design phase. A construction phasing plan will be established after the bidding phase for this project when a contractor has been selected at which time the Stormwater Pollution Prevention Plan will be prepared and submitted.

Because the Project will disturb more than one (1) acre of land, a Notice of Intent will be submitted to the Environmental Protection Agency (EPA) for coverage under the National Pollution Discharge Elimination

System (NPDES) Construction General Permit. As part of this application the Applicant is required to prepare a Stormwater Pollution Prevention Plan (SWPPP) and implement the measures in the SWPPP. The SWPPP, which is to be kept on site, includes erosion and sediment controls (stabilization practices and structural practices), temporary and permanent stormwater management measures, Contractor inspection schedules and reporting of all SWPPP features, materials management, waste disposal, off-site vehicle tracking, spill prevention and response, sanitation, and non-stormwater discharges

The soil erosion and sediment control measures that will be proposed as part of this project include erosion control barriers like geotextile silt fences and compost filter socks, stabilization practices, phased construction sequencing, and a construction entrance. The 12/16/2025 Site Plan Alternative gravel access road will also be constructed to prevent sediment transport, rutting, or channelized flow during and after construction. Construction BMPs must be maintained. Construction period pollution prevention and erosion and sediment control shall meet the requirements for the most current EPA Construction General Permit (CGP) for all projects requiring coverage under the CGP. A project-specific Stormwater Pollution Prevention Plan (SWPPP) will be prepared prior to construction and updated as necessary to reflect final drainage design. See details below.

Short Term Erosion Control:

The proposed erosion and sedimentation controls consider the specific characteristics of the site and the anticipated construction activities. They have been designed in accordance with the latest MassDEP Guidelines for Soil Erosion and Sediment Control.

Construction Entrances:

Construction entrances will be utilized to remove sediment from construction vehicle tires and prevent it from being tracked onto adjoining paved roadway areas. Maintain the pad in a condition that will prevent tracking and washing of sediment onto paved surfaces. Place additional clean gravel on top of gravel that has become silted or remove the silted gravel and replace the gravel to the depth removed with clean gravel, as conditions warrant. Remove immediately all sediment spilled, dropped, washed, or tracked onto paved surfaces.

Erosion Control Barriers:

Prior to any construction activity, barriers will be placed at the downgradient limits of construction and adjacent to the wetlands. Barriers will be inspected at least once a week and within 24 hours after the end of a storm generating a discharge. Barriers will be maintained until the contributing disturbed areas are stabilized.

Inlet Protection:

Prior to any construction activity, inlet protection will be placed at the downgradient catch basins and inlets. Inlet protection should be inspected at least once a week and within 24 hours after the end of a storm generating a discharge. Inlet protection will be maintained until the contributing disturbed areas are restored.

Stockpile Management:

The topsoil stockpiles which will be idle for at least 30 days will be stabilized with temporary seed and mulch no later than 7 days from the last use. Small stockpiles may be covered with impervious tarps or erosion control matting in lieu of seeding and mulching. A geotextile silt fence or hay bale barrier will be installed around the stockpile area approximately 10 feet from the proposed toe of the slope. Inspect temporary stockpiles at the end of each workday to ensure that tarps are in place and secured.

3.4.9 Standard 9 – Operation and Maintenance Plan

A post-construction Stormwater Operation and Maintenance (O&M) Plan, which identifies required inspection and maintenance activities for structural stormwater BMPs is provided in **Appendix J**. The owner shall be responsible for construction operation and maintenance of the site.

3.4.10 Standard 10 – Prohibition of Illicit Discharges

No illicit discharges as outlined in Massachusetts Stormwater Handbook are proposed as part of this project.

4. Summary

In summary, the proposed stormwater management system design, illustrated within the site development drawings prepared by Arup meets the standards set forth in the Massachusetts Stormwater Handbook. The proposed development results in an increase in impervious area when compared to existing conditions. To manage the increase in runoff associated with the increase in impervious area, the project includes the utilization of two dry detention basins for peak flow mitigation. As outlined in the tables above, the proposed stormwater management system as designed will provide a decrease in peak rates of runoff from the proposed facility for the 2-, 10-, and 100-year storm events. The project has been designed to the greatest extent feasible to maintain existing site hydrology. As a result, the proposed project will not result in any adverse conditions to the surrounding areas and properties. Supporting documentation and stormwater-related computations are contained in the Appendices of this report.

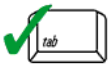
Appendix A: MassDEP Stormwater Checklist

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
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Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

2/28/2025

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

- ☒ New development
- ☐ Redevelopment
- ☐ Mix of New Development and Redevelopment

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☐ No disturbance to any Wetland Resource Areas
- ☒ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of “country drainage” versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☒ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): _____

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☐ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☒ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☐ Soil Analysis provided.

☐ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☐ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☐ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☐ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☐ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

☒ The ½" or 1" Water Quality Volume or

☒ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☒ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☒ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☐ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☒ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☐ Name of the stormwater management system owners;
- ☐ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

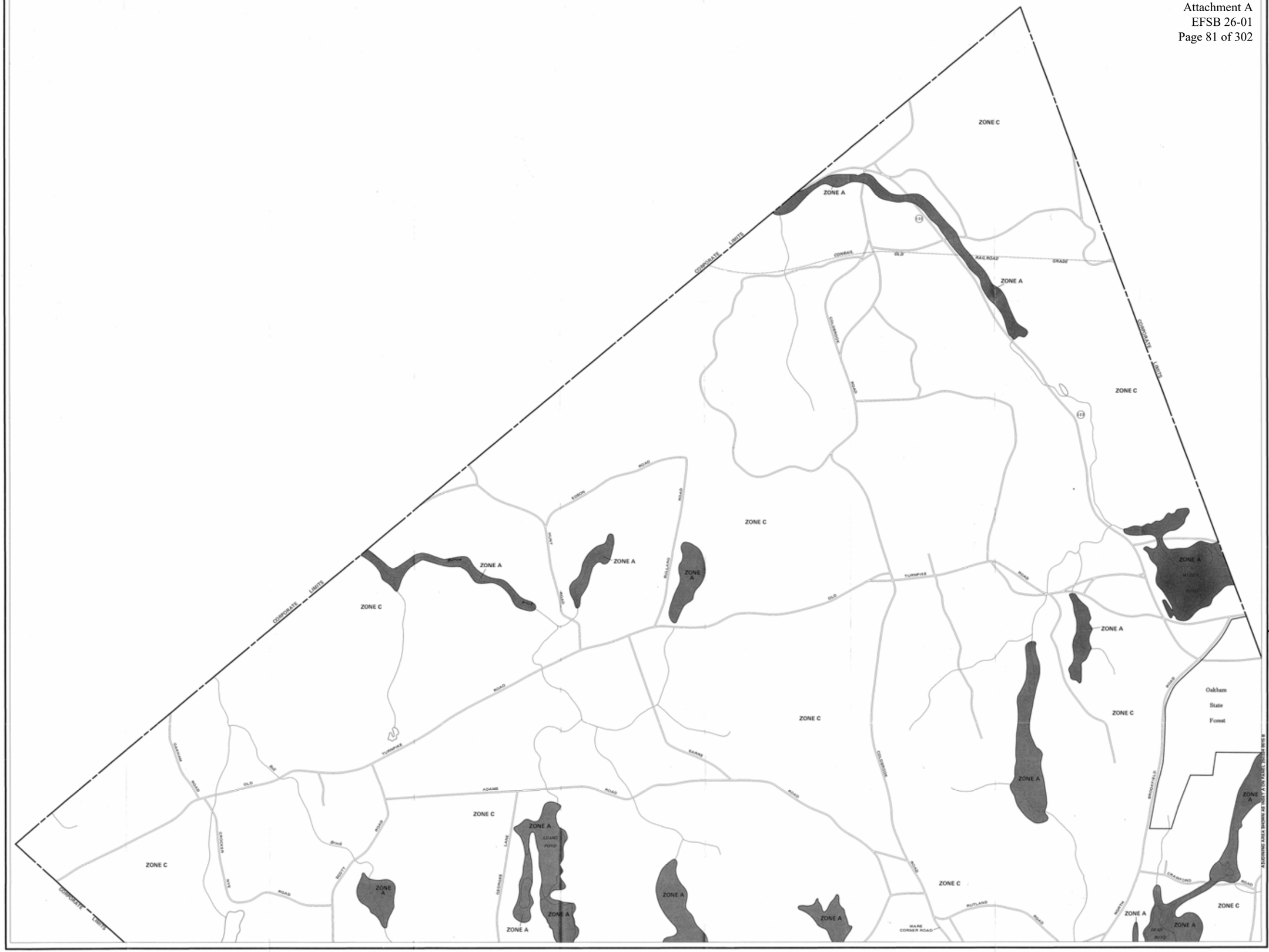
Standard 10: Prohibition of Illicit Discharges

☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ An Illicit Discharge Compliance Statement is attached;

☒ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Appendix B: FEMA Firm Panel



KEY TO MAP

100-Year Flood Boundary
100-Year Flood Boundary
Zone Designations*
100-Year Flood Boundary
100-Year Flood Boundary
Base Flood Elevation Line With Elevation In Feet**
Base Flood Elevation in Feet Where Uniform Within Zone**
Elevation Reference Mark
Zone D Boundary
River Mile

ZONE A
ZONE A01-30
ZONE B

513
(EL 987)
RM7×
•M1.5

**Referenced to the National Geodetic Vertical Datum of 1929

*EXPLANATION OF ZONE DESIGNATIONS

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
AO	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
A01	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
AH	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

NOTES TO USER

Certain areas not in the special flood hazard areas (zones A and V) may be protected by flood control structures.

This map is for flood insurance purposes only; it does not necessarily show all areas subject to flooding in the community or all planimetric features outside special flood hazard areas.

For adjoining map panels, see separately printed Index To Map Panels.

INITIAL IDENTIFICATION:
AUGUST 2, 1974
FLOOD HAZARD BOUNDARY MAP REVISIONS:
AUGUST 20, 1976

FLOOD INSURANCE RATE MAP EFFECTIVE:
APRIL 3, 1984
FLOOD INSURANCE RATE MAP REVISIONS:

Refer to the FLOOD INSURANCE RATE MAP EFFECTIVE date shown on this map to determine when actuarial rates apply to structures in the zones where elevations or depths have been established.

To determine if flood insurance is available in this community, contact your insurance agent, or call the National Flood Insurance Program, at (800) 638-6620.

APPROXIMATE SCALE
800 0 800 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

TOWN OF
OAKHAM,
MASSACHUSETTS
WORCESTER COUNTY

PANEL 5 OF 15
(SEE MAP INDEX FOR PANELS NOT PRINTED)

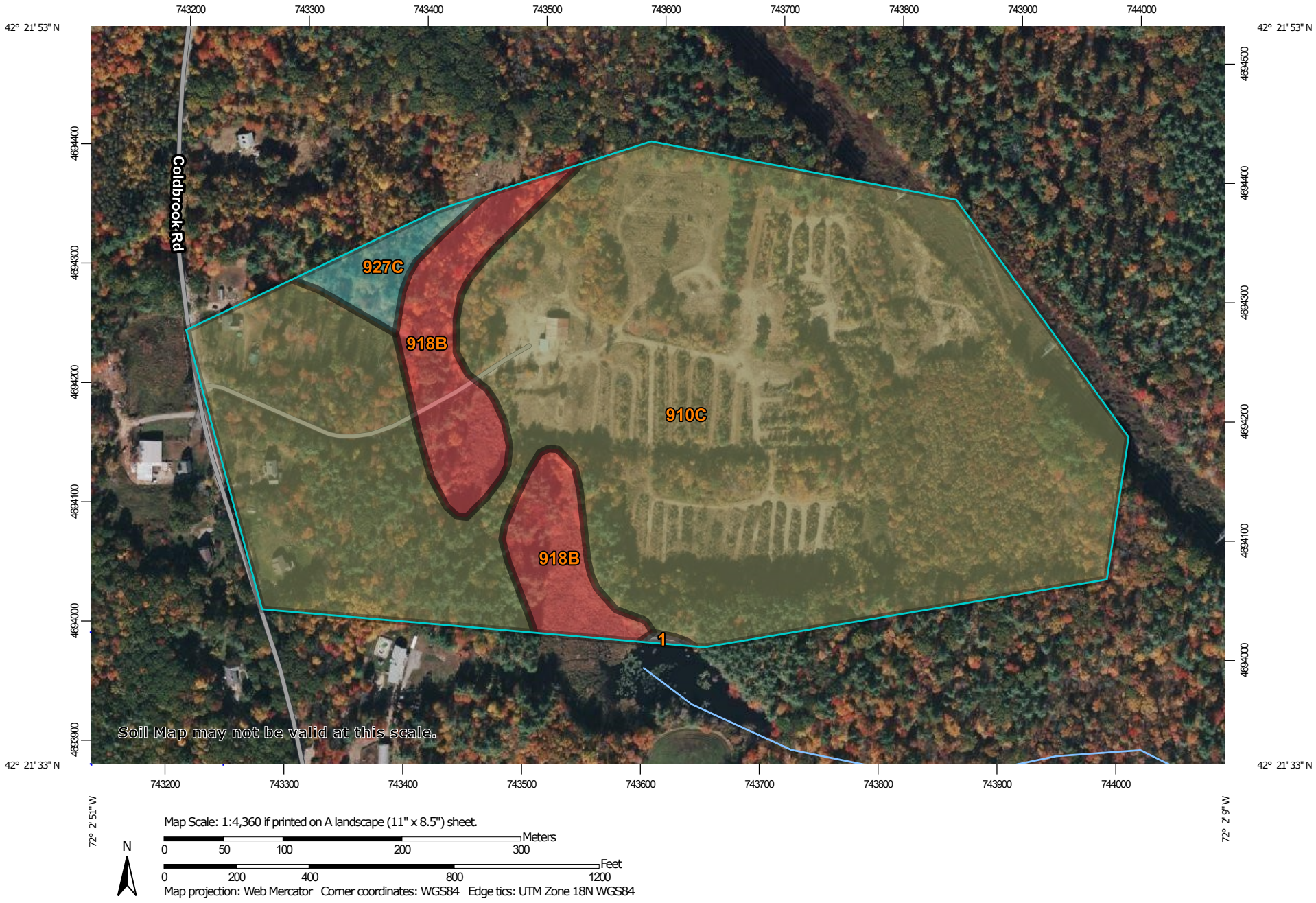
COMMUNITY-PANEL NUMBER
250324 0005 B

EFFECTIVE DATE:
APRIL 3, 1984

Federal Emergency Management Agency

Appendix C: NRCS Soil Survey & Environmental Data

Hydrologic Soil Group—Worcester County, Massachusetts, Northwestern Part



Map Scale: 1:4,360 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Worcester County, Massachusetts, Northwestern Part
Survey Area Data: Version 18, Aug 27, 2024

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 15, 2020—Oct 31, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Water		0.1	0.1%
910C	Woodbridge-Paxton association, 3 to 15 percent slopes, extremely stony	C/D	55.0	87.5%
918B	Ridgebury-Whitman association, 0 to 8 percent slopes, extremely stony	D	6.4	10.2%
927C	Montauk-Scituate-Canton association, 3 to 15 percent slopes, extremely stony	C	1.4	2.2%
Totals for Area of Interest			**62.8**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

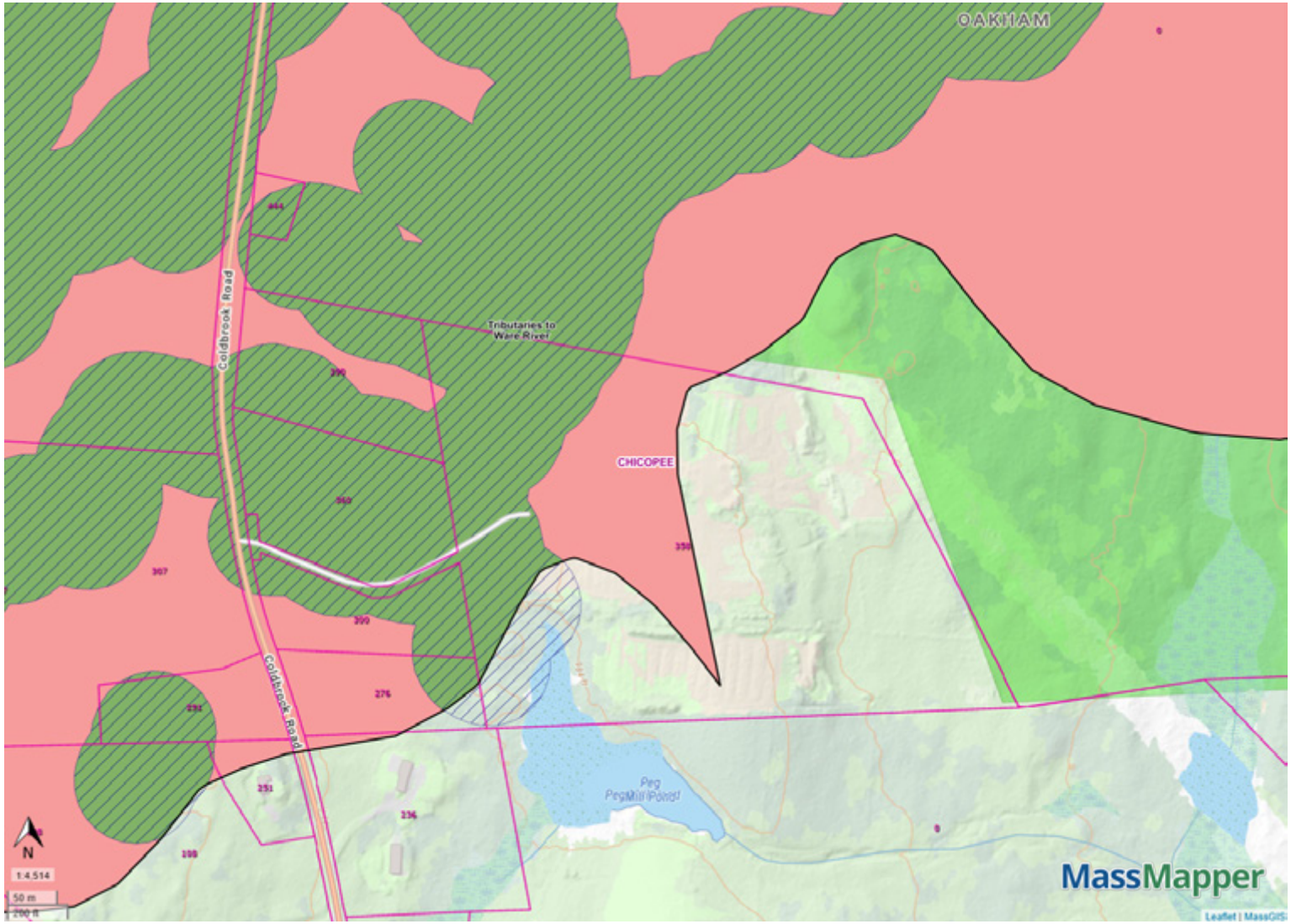
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Surface Water Supply



DEP 2013 Boundaries for Tributaries thereto Watersheds

Labels

Major Watersheds

Property Tax Parcels

Detailed Features

Zone A

Zone B

Zone C

Surface Water Supply Watersheds

- Surface Water (Active or Inactive)
- Emergency Surface Water
- Rhode Island Source

Phone
(203) 262-9328

Telefax
(203) 264-3414

WHITE PLAINS, N.Y.
(914) 946-4850

SOILTESTING, INC.

90 DONOVAN ROAD - OXFORD, CONN. 06478-1028

GEOTECHNICAL / ENVIRONMENTAL SUBSURFACE INVESTIGATIONS - Test Borings - Core Drilling
Monitoring Wells - Recovery Wells - Direct Push/Probe Sampling
UNDERPINNING - HELICAL PILES - SOIL NAILS

January 6, 2025

Rhyland Energy
750 Lexington Ave.
New York NY 10022
Attn.: Jon O'Hara

Re: 300 Coldbrook Road
Oakham MA

G226-3040-24

Dear Mr. O'Hara,

Attached please find the Test Boring Logs and location plan for work in Oakham MA along with our invoice.

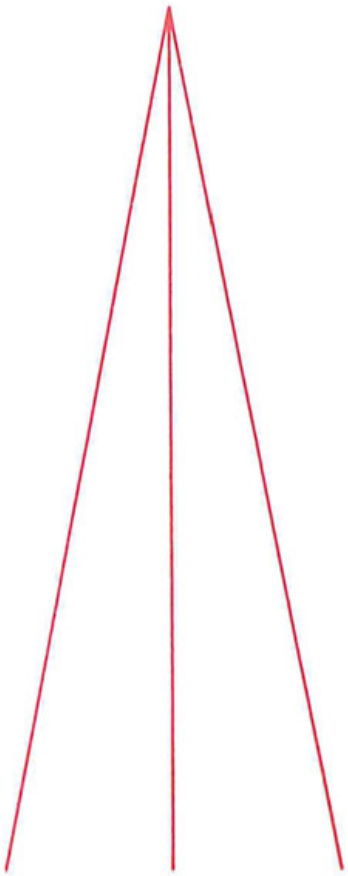
If you have any questions, please do not hesitate to contact us.

Very truly yours,

James A. DeAngelis
President

SOILTESTING, INC.

TO	Rhyland Energy	DATE	6-Jan-25
ADDRESS	750 Lexington Ave., New York NY 10022		
SITE LOCATION	300 Coldbrook Rd., Oakham MA		
REPORT SENT TO	Jon O'Hara		
SAMPLES SENT TO	Storage (Max 60 days)		



90 Donovan Road
Oxford, Connecticut 06478-1028
203-262-9328

Branch Office:
White Plains, New York 10607
914-946-4850

JOB NO.

G226-3040-24

SOILTESTING, INC.
90 DONOVAN RD.
OXFORD, CT 06478
CT (203) 262-9328
NY (914) 946-4850

CLIENT: Rhyland Energy
SHEET 1 OF 1
HOLE NO. B-1
PROJECT NO. G226-3040-24
PROJECT NAME Subsurface Investigations
BORING LOCATIONS Per Plan
FOREMAN - DRILLER SD/dw
LOCATION 300 Coldbrook Road Oakham MA
INSPECTOR
OFFSET

	CASING	SAMPLER	CORE BAR
TYPE	HSA	SS	
SIZE I.D.	4 ¼"	1 3/8"	
HAMMER WT.		140#	BIT
HAMMER FALL		30"	

DATE START 12/23/24
DATE FINISH 12/23/24
SURFACE ELEV.
GROUND WATER ELEV.

GROUND WATER OBSERVATIONS
AT none FT AFTER 0 HOURS
AT __ FT AFTER __ HOURS

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO	Type	PEN	REC	DEPTH @ BOT	BLOWS PER 6 IN ON SAMPLER (FORCE ON TUBE) 0 - 6 / 6 - 12 / 12 - 18	CORE TIME PER FT (MIN)	DENSITY OR CONSIST / MOIST	STRATA CHANGE DEPTH / ELEV	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
		1	ss	24"	10"	2'0"	2 / 2		loose	4"	Topsoil
							3 / 3		moist		Brn F-M SAND & SILT
		2	ss	24"	2"	4'0"	3 / 4		loose		
							3 / 3		moist		Same
5											
		3	ss	24"	24"	7'0"	4 / 6		compact		
							7 / 8		moist		Same, (gry)
		4	ss	24"	24"	9'0"	5 / 7		compact		
							6 / 9		moist	9'6"	Same, (gry)
10		5	ss	1"	0"	9'7"	50/1"		dense/dry	9'7"	Poss Bedrock, Auger Refusal
											EOB 9'7"
15											
20											
25											
30											
35											
40											

NOTE: Subsoil conditions revealed by this investigation represent conditions at specific locations and may not represent conditions at other locations or times.

GROUND SURFACE TO _____FT. USED _____CASING THEN _____ CASING TO _____FT. HOLE NO. B-1
A = AUGER UP = UNDISTURBED PISTON T = THINWALL V = VANE TEST
WOR = WEIGHT OF RODS WOH = WEIGHT OF HAMMER & RODS C = COARSE
SS = SPLIT TUBE SAMPLER H.S.A. = HOLLOW STEM AUGER M = MEDIUM
PROPORTIONS USED: TRACE = 0 - 10% LITTLE = 10 - 20% SOME = 20 - 35% AND =35 - 50% F = FINE

SOILTESTING, INC.
90 DONOVAN RD.
OXFORD, CT 06478
CT (203) 262-9328
NY (914) 946-4850

CLIENT: Rhyland Energy
SHEET 1 OF 1
HOLE NO. B-2
PROJECT NO. G226-3040-24
PROJECT NAME Subsurface Investigations
BORING LOCATIONS Per Plan
FOREMAN - DRILLER SD/dw
LOCATION 300 Coldbrook Road Oakham MA
INSPECTOR
OFFSET 5' South
DATE START 12/23/24
DATE FINISH 12/23/24
SURFACE ELEV.
GROUND WATER ELEV.

GROUND WATER OBSERVATIONS
AT 10 FT AFTER 0 HOURS
AT ___ FT __ AFTER __ HOURS

	CASING	SAMPLER	CORE BAR
TYPE	HSA	SS	
SIZE I.D.	4 ¼"	1 3/8"	
HAMMER WT.		140#	BIT
HAMMER FALL		30"	

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO	Type	PEN	REC	DEPTH @ BOT	BLOWS PER 6 IN ON SAMPLER (FORCE ON TUBE) 0 - 6	6 - 12	12 - 18	CORE TIME PER FT (MIN)	DENSITY OR CONSIST / MOIST	STRATA CHANGE DEPTH / ELEV	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
		1	ss	24"	14"	2'0"	4	7			compact	6"	Topsoil
							8	6			dry		Brn F-M SAND & SILT, lit F gravel
		2	ss	24"	20"	4'0"	10	14			compact		
							15	12			dry		Same
5													
		3	ss	24"	10"	7'0"	5	8			compact		
							21	38			dry		Gry F-M SAND & SILT, some F gravel
		4	ss	24"	18"	9'0"	41	26			v dense		
							31	17			dry		Same
10													
		5	ss	24"	18"	12'0"	12	14			compact		
							15	20			wet		Same
15													
		6	ss	24"	6"	16'8"	8	12			compact	16'6"	
							17	50/2"			dry	17'	Partially weathered Bedrock or Boulder fragments
													EOB 17' Auger Refusal
20													
25													
30													
35													
40													

NOTE: Subsoil conditions revealed by this investigation represent conditions at specific locations and may not represent conditions at other locations or times.

GROUND SURFACE TO _____FT. USED _____CASING THEN _____ CASING TO _____FT. HOLE NO. B-2
A = AUGER UP = UNDISTURBED PISTON T = THINWALL V = VANE TEST
WOR = WEIGHT OF RODS WOH = WEIGHT OF HAMMER & RODS C = COARSE
SS = SPLIT TUBE SAMPLER H.S.A. = HOLLOW STEM AUGER M = MEDIUM
PROPORTIONS USED: TRACE = 0 - 10% LITTLE = 10 - 20% SOME = 20 - 35% AND =35 - 50% F = FINE

SOILTESTING, INC.
90 DONOVAN RD.
OXFORD, CT 06478
CT (203) 262-9328
NY (914) 946-4850

CLIENT: Rhynland Energy

SHEET 1 OF 1

PROJECT NO. G226-3040-24

PROJECT NAME 300 Coldbrook Road

BORING/PERCOLATION TEST
LOCATION #: B-2

TECHNICIAN: SD

LOCATION Oakham MA

INSPECTOR

PERCOLATION TEST

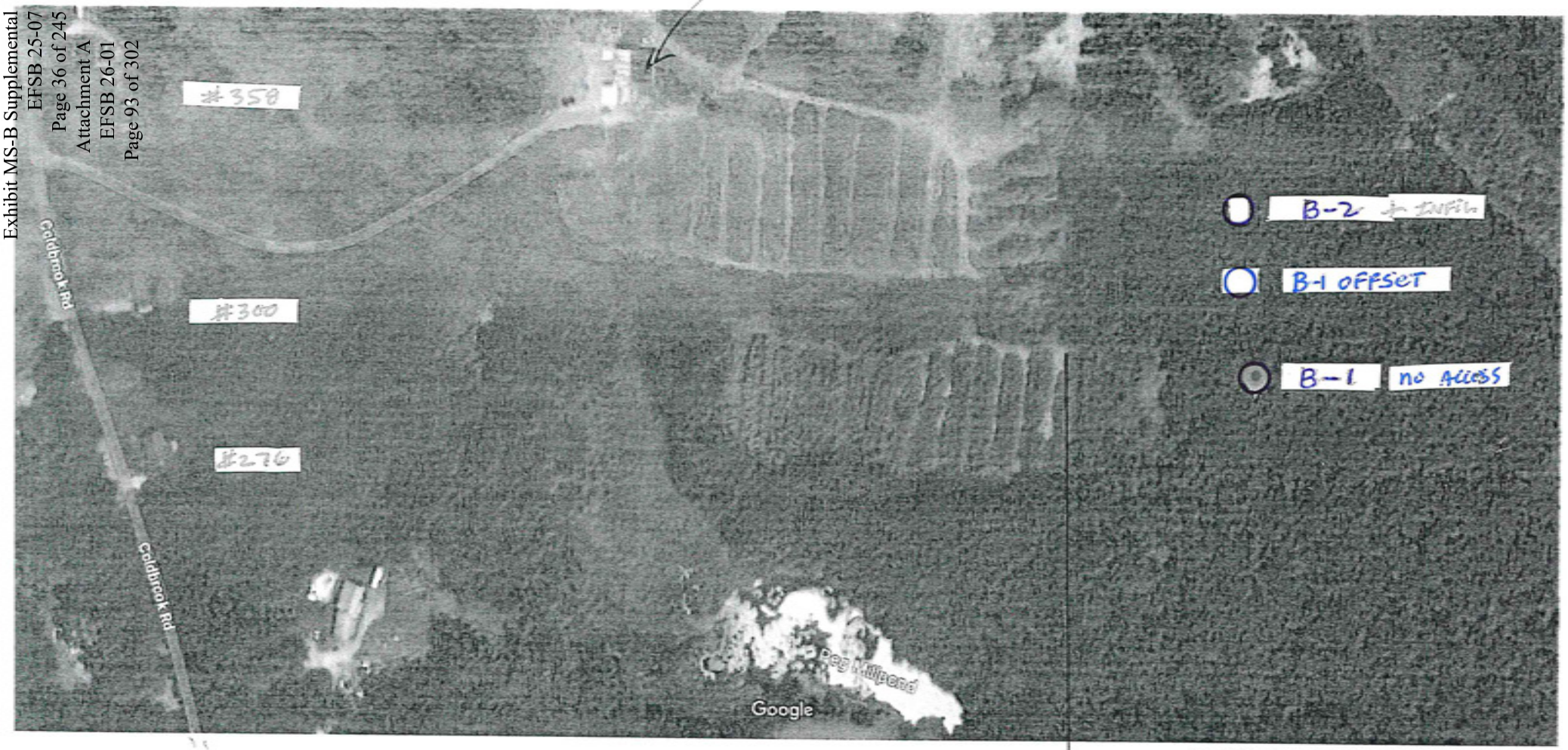
OFFSET

DATE START 12/23/24

DATE FINISH 12/23/24

CASING DIAMETER: 4"
OVERALL CASING LENGTH: 78"
CASING STICK-UP (A.G. Surface): 6"
ADJACENT OBSERVATION WELL GROUNDWATER LEVEL READING: N/A
DEPTH TO GROUNDWATER LEVEL _____ DATE/TIME N/A
PRESOAK DATE:

Time	Water Level from Top of Casing	Notes
1:05PM	48"	Intial Full
2:05PM	49"	
3:05PM	49 3/4"	
3:10PM	48"	2nd Fill
4:10PM	48 3/4"	
		Percolation Rate = 3/4" per hour



1600' +/-

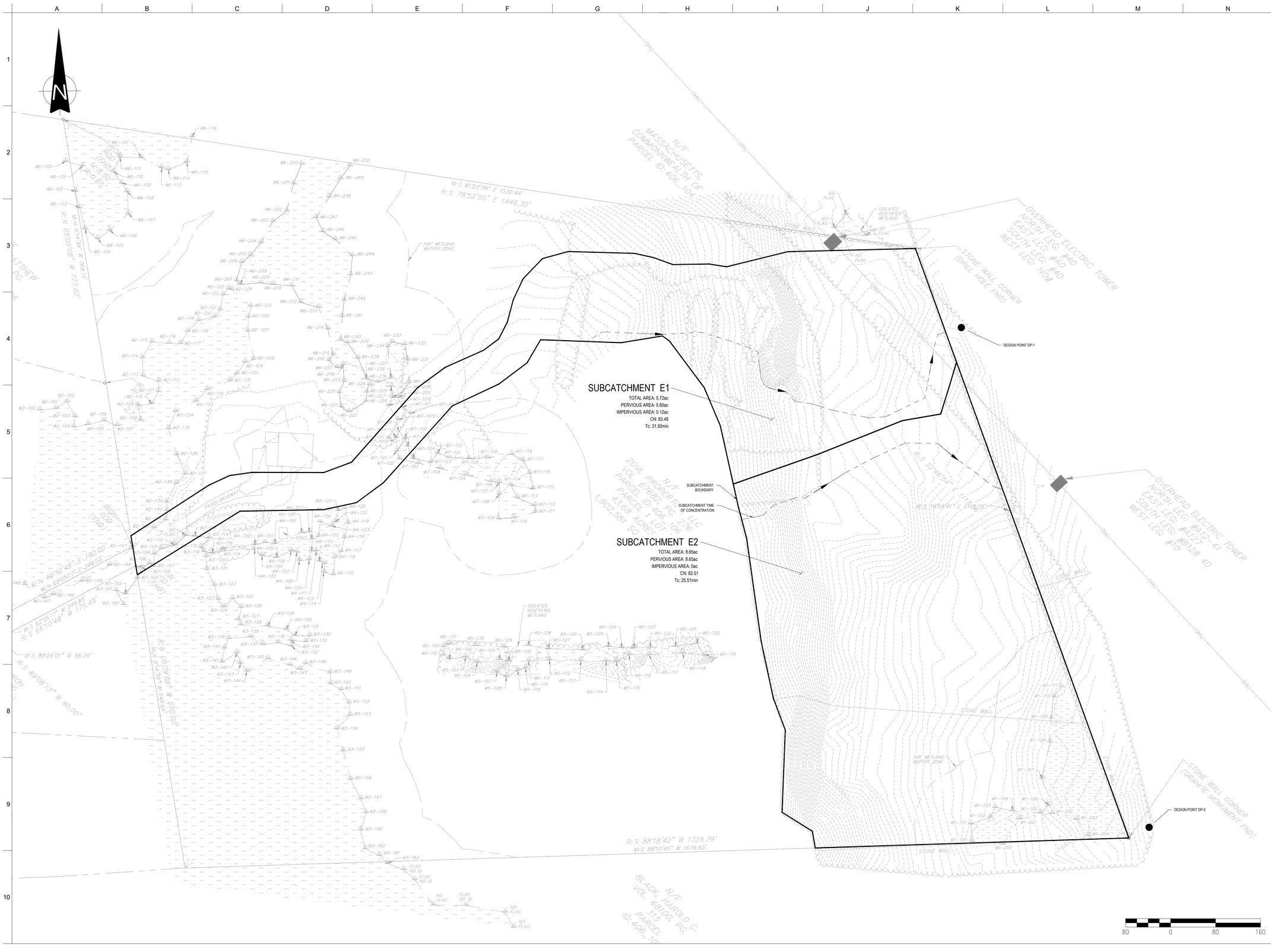
330' +/-

DEACON ALLEN DRIVE

(Behind) 300 COLD BROOK RD, OAKHAM MASS

Appendix D: Pre & Post Development Catchment Maps

PLOT BY: Reese Smith PLOT TIME: 3/13/2025 4:04 PM



Issue	Date	Revisions
A	9/22/23	DRAFT ISSUED FOR REVIEW
B	9/28/23	CONSTRAINT MAPPING
C	8/21/24	10% DESIGN SUBMISSION
D	9/13/24	30% DESIGN DRAFT
E	11/01/24	ISSUED FOR ISO-NE SIS APPLICATION
F	02/28/2025	30% DESIGN
G	03/18/2025	30% DESIGN REVISION

ARUP

60 State Street , Boston, MA
02109, United States

www.arup.com

Client

MORAGA STORAGE LLC

Job Title

MORAGA STORAGE
ZOVL - Oakham, MA

Seal

NOT FOR CONSTRUCTION

Drawing Title

EXISTING SUBCATCHMENT MAP

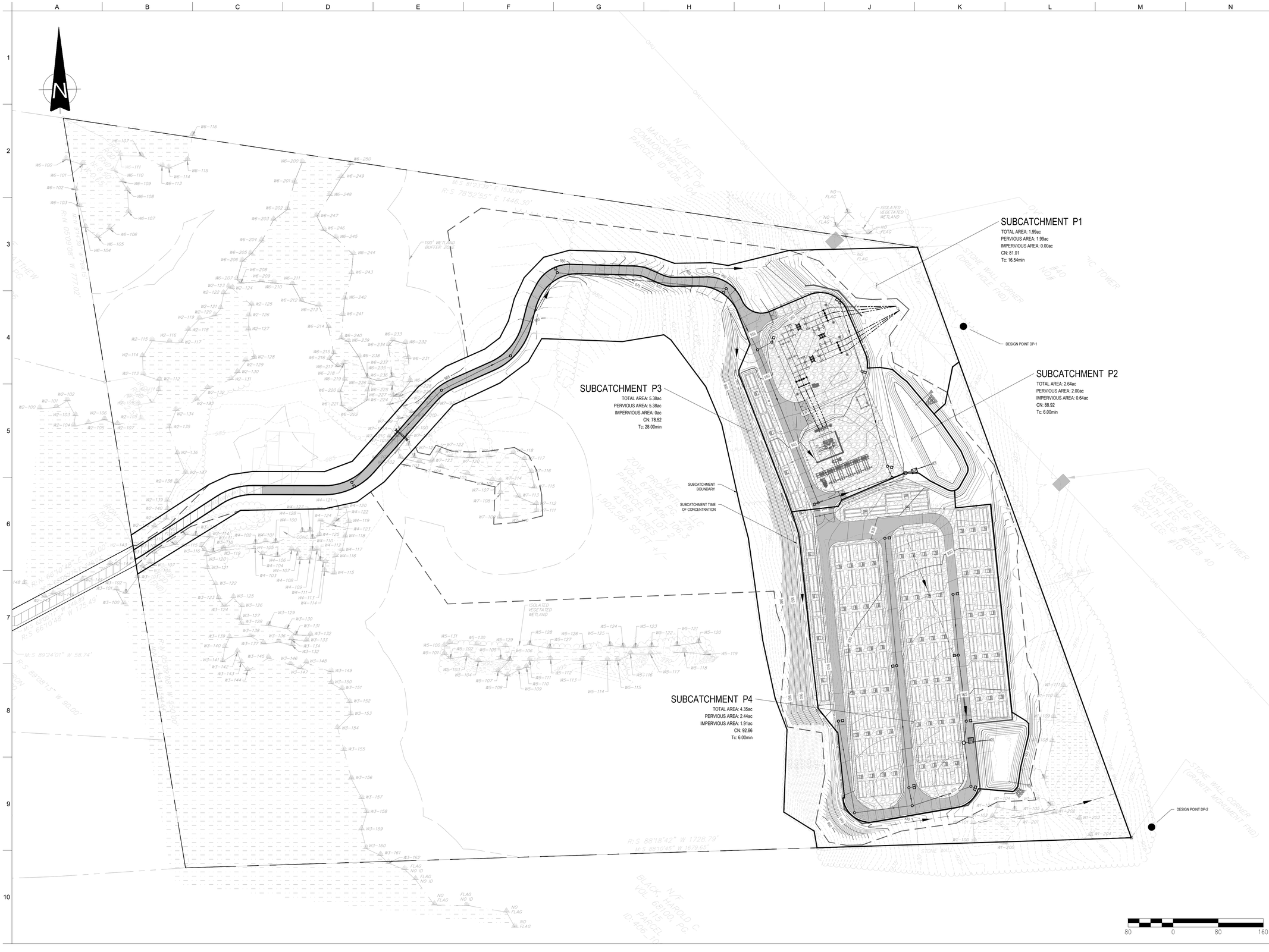
Scale 1" = 80'

File Name SUBCATCH-PRE_R1.DWG

Drawing Status
30% DESIGN DRAWINGS

Job No	Drawing No	Issue
296229-00		G

PLOT BY: Reese Smith PLOT TIME: 3/19/2025 1:51 PM



Issue	Date	Revisions
A	9/22/23	DRAFT ISSUED FOR REVIEW
B	9/28/23	CONSTRAINT MAPPING
C	8/21/24	10% DESIGN SUBMISSION
D	9/13/24	30% DESIGN DRAFT
E	11/01/24	ISSUED FOR ISO-NE SIS APPLICATION
F	02/28/2025	30% DESIGN
G	03/18/2025	30% DESIGN REVISION

ARUP

60 State Street , Boston, MA
02109, United States

www.arup.com

Client
MORAGA STORAGE LLC

Job Title
MORAGA STORAGE
ZOVL - Oakham, MA

Seal

NOT FOR CONSTRUCTION

Drawing Title
PROPOSED SUBCATCHMENT MAP

Scale
1" = 80'

File Name
SUBCATCH-POST.DWG

Drawing Status
30% DESIGN DRAWINGS

Job No	Drawing No	Issue
296229-00		G

Appendix E: Pipe Sizing Calculations

Moraga Storage LLC - ZOVL
358 Coldbrook Road
Oakham, MA
Arup Job Number: 296229
3/18/2025

Rational Pipe Sizing Calculations

Design Period Storm:		**25**	**Year**	**Design Period Intensity**			**7.4**	**in/hr**	**<<RMAT Mid-Century Rainfall**								
LOCATION		IMPERVIOUS			PERVIOUS												
FROM	TO	A	C	CA	A	C	CA	SUM CA	Tc (min)	I (in/hr)	Q (cfs)	D (in)	S (ft/ft)	Material	n	Q Full (cfs)	V Full (fps)
DP-1																	
CB-1	MH-1	0.14	0.95	0.14	0.00	0.30	0.00	0.14	6	7.4	1.01	8	0.030	HDPE	0.012	2.27	6.50
MH-1	MH-2	0.14	0.95	0.14	0.00	0.30	0.00	0.14	6	7.4	1.01	8	0.006	HDPE	0.012	1.01	2.90
MH-2	MH-3	0.14	0.95	0.14	0.00	0.30	0.00	0.14	6	7.4	1.01	8	0.007	HDPE	0.012	1.07	3.07
CB-2	MH-4	0.12	0.95	0.11	0.00	0.30	0.00	0.11	6	7.4	0.82	8	0.013	HDPE	0.012	1.46	4.19
MH-3	MH-4	0.14	0.95	0.14	0.00	0.30	0.00	0.14	6	7.4	1.01	8	0.017	HDPE	0.012	1.70	4.88
MH-4	MH-5	0.26	0.95	0.25	0.00	0.30	0.00	0.25	6	7.4	1.84	8	0.048	HDPE	0.012	2.87	8.22
CB-3	MH-5	0.12	0.95	0.12	0.00	0.30	0.00	0.12	6	7.4	0.86	8	0.010	HDPE	0.012	1.31	3.75
MH-5	MH-7	0.38	0.95	0.36	0.00	0.30	0.00	0.36	6	7.4	2.70	8	0.050	HDPE	0.012	2.93	8.39
CB-4	MH-6	0.08	0.95	0.07	0.05	0.30	0.01	0.09	6	7.4	0.64	8	0.008	HDPE	0.012	1.17	3.35
MH-6	MH-7	0.08	0.95	0.07	0.05	0.30	0.01	0.09	6	7.4	0.64	8	0.006	HDPE	0.012	1.04	2.98
MH-7	MH-8	0.46	0.95	0.44	0.05	0.30	0.01	0.45	6	7.4	3.33	12	0.026	HDPE	0.012	6.22	7.92
CB-5	MH-8	0.21	0.95	0.20	0.16	0.30	0.05	0.25	6	7.4	1.83	12	0.010	HDPE	0.012	3.86	4.91
MH-8	MH-12	0.67	0.95	0.64	0.21	0.30	0.06	0.70	6	7.4	5.16	18	0.007	HDPE	0.012	9.52	5.39
HDS-1	JFV-1	0.74	0.95	0.71	1.23	0.30	0.37	1.07	6	7.4	7.95	24	0.006	HDPE	0.012	18.98	6.04
JFV-1	POND1	0.74	0.95	0.71	1.23	0.30	0.37	1.07	6	7.4	7.95	24	0.005	HDPE	0.012	17.33	5.52
CB-6	MH-9	0.01	0.95	0.01	0.00	0.30	0.00	0.01	6	7.4	0.05	8	0.013	HDPE	0.012	1.46	4.19
MH-9	MH-10	0.01	0.95	0.01	0.00	0.30	0.00	0.01	6	7.4	0.05	8	0.006	HDPE	0.012	1.00	2.86
CB-7	MH-10	0.00	0.95	0.00	0.55	0.30	0.17	0.17	6	7.4	1.24	12	0.013	HDPE	0.012	4.32	5.49
MH-10	MH-11	0.01	0.95	0.01	0.55	0.30	0.17	0.17	6	7.4	1.28	12	0.030	HDPE	0.012	6.69	8.51
CB-8	MH-11	0.06	0.95	0.06	0.47	0.30	0.14	0.20	6	7.4	1.51	12	0.010	HDPE	0.012	3.86	4.91
MH-11	MH-12	0.07	0.95	0.07	1.02	0.30	0.31	0.38	6	7.4	2.79	24	0.007	HDPE	0.012	19.76	6.29
MH-12	HDS-1	0.74	0.95	0.71	1.50	0.30	0.45	1.15	6	7.4	8.55	24	0.005	HDPE	0.012	17.84	5.68

Prepared By:
ARUP
60 State Street
Boston, MA 02109
(617) 864-2987

DP-2																	
CB-9	MH-13	0.16	0.95	0.16	0.14	0.30	0.04	0.20	6	7.4	1.46	8	0.025	HDPE	0.012	2.07	5.93
MH-13	MH-14	0.16	0.95	0.16	0.14	0.30	0.04	0.20	6	7.4	1.46	12	0.009	HDPE	0.012	3.66	4.66
MH-14	MH-18	0.16	0.95	0.16	0.14	0.30	0.04	0.20	6	7.4	1.46	12	0.040	HDPE	0.012	7.72	9.83
CB-10	MH-15	0.19	0.95	0.18	0.15	0.30	0.05	0.23	6	7.4	1.67	8	0.025	HDPE	0.012	2.07	5.93
MH-15	MH-16	0.19	0.95	0.18	0.15	0.30	0.05	0.23	6	7.4	1.67	12	0.009	HDPE	0.012	3.64	4.64
CB-11	MH-16	0.19	0.95	0.18	0.30	0.30	0.09	0.27	6	7.4	1.98	8	0.025	HDPE	0.012	2.07	5.93
MH-16	MH-17	0.38	0.95	0.36	0.45	0.30	0.14	0.49	6	7.4	3.65	18	0.008	HDPE	0.012	10.18	5.76
CB-12	MH-17	0.38	0.95	0.36	0.34	0.30	0.10	0.47	6	7.4	3.45	12	0.025	HDPE	0.012	6.10	7.77
MH-17	MH-18	0.76	0.95	0.72	0.79	0.30	0.24	0.96	6	7.4	7.10	18	0.009	HDPE	0.012	10.80	6.11
MH-18	MH-22	0.92	0.95	0.88	0.93	0.30	0.28	1.16	6	7.4	8.56	18	0.008	HDPE	0.012	10.18	5.76
CB-16	MH-22	0.38	0.95	0.36	0.34	0.30	0.10	0.46	6	7.4	3.39	12	0.025	HDPE	0.012	6.10	7.77
MH-22	HDS-2	1.30	0.95	1.23	1.27	0.30	0.38	1.61	6	7.4	11.95	18	0.020	HDPE	0.012	16.09	9.11
CB-13	MH-19	0.21	0.95	0.20	0.29	0.30	0.09	0.28	6	7.4	2.10	12	0.025	HDPE	0.012	6.10	7.77
MH-19	MH-20	0.21	0.95	0.20	0.29	0.30	0.09	0.28	6	7.4	2.10	12	0.009	HDPE	0.012	3.66	4.66
CB-14	MH-20	0.19	0.95	0.18	0.33	0.30	0.10	0.28	6	7.4	2.05	8	0.025	HDPE	0.012	2.07	5.93
MH-20	MH-21	0.39	0.95	0.37	0.62	0.30	0.19	0.56	6	7.4	4.15	18	0.010	HDPE	0.012	11.49	6.50
CB-15	MH-21	0.22	0.95	0.21	0.21	0.30	0.06	0.27	6	7.4	2.02	8	0.025	HDPE	0.012	2.07	5.93
MH-21	HDS-2	0.62	0.95	0.59	0.83	0.30	0.25	0.83	6	7.4	6.18	18	0.020	HDPE	0.012	16.09	9.11
HDS-2	JFV-2	1.92	0.95	1.82	2.10	0.30	0.63	2.45	6	7.4	18.13	24	0.012	HDPE	0.012	26.85	8.55
JFV-2	POND2	1.92	0.95	1.82	2.10	0.30	0.63	2.45	6	7.4	18.13	24	0.006	HDPE	0.012	18.98	6.04

Appendix F: Water Quality Calculations

Moraga Storage LLC - ZOVL
358 Coldbrook Road
Oakham, MA
Arup Job Number: 296229
March 18, 2025

Water Quality Volume (WQV) Calculation

DRY POND 1

Catch Basin #1 (CB-1)

WQF = (qu) x (A) x (WQV)

WQV =	1.0	inches	
Qu =	774.0	csm/in based on time of concentration of 6 minutes (0.1 hours) per table	
A (impervious area) =	0.000225	sq mi	
WQF =	0.174	cfs	

Catch Basin #2 (CB-2)

WQF = (qu) x (A) x (WQV)

WQV =	1.0	inches	
Qu =	774.0	csm/in based on time of concentration of 6 minutes (0.1 hours) per table	
A (impervious area) =	0.000183	sq mi	
WQF =	0.141	cfs	
Total WQF =	0.316	cfs	CBs #1-2

Catch Basin #3 (CB-3)

WQF = (qu) x (A) x (WQV)

WQV =	1.0	inches	
Qu =	774.0	csm/in based on time of concentration of 6 minutes (0.1 hours) per table	
A (impervious area) =	0.000191	sq mi	
WQF =	0.148	cfs	
Total WQF =	0.464	cfs	CBs #1-3

Catch Basin #4 (CB-4)

WQF = (qu) x (A) x (WQV)

WQV =	1.0	inches	
Qu =	774.0	csm/in based on time of concentration of 6 minutes (0.1 hours) per table	
A (impervious area) =	0.000118	sq mi	
WQF =	0.091	cfs	
Total WQF =	0.555	cfs	CBs #1-4

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Catch Basin #5 (CB-5)

WQF = (qu) x (A) x (WQV)			
WQV =	1.0	inches	
Qu =	774.0	csm/in based on time of concentration of 6 minutes (0.1 hours) per table	
A (impervious area) =	0.000328	sq mi	
WQF =	0.254	cfs	
Total WQF =	0.809	cfs	CBs #1-5

Catch Basin #6 (CB-6)

WQF = (qu) x (A) x (WQV)			
WQV =	1.0	inches	
Qu =	774.0	csm/in based on time of concentration of 6 minutes (0.1 hours) per table	
A (impervious area) =	0.000010	sq mi	
WQF =	0.008	cfs	

Catch Basin #7 (CB-7)

WQF = (qu) x (A) x (WQV)			
WQV =	1.0	inches	
Qu =	774.0	csm/in based on time of concentration of 6 minutes (0.1 hours) per table	
A (impervious area) =	0.000004	sq mi	
WQF =	0.003	cfs	
Total WQF =	0.011	cfs	CBs #6-7

Catch Basin #8 (CB-8)

WQF = (qu) x (A) x (WQV)			
WQV =	1.0	inches	
Qu =	774.0	csm/in based on time of concentration of 6 minutes (0.1 hours) per table	
A (impervious area) =	0.000101	sq mi	
WQF =	0.078	cfs	
Total WQF =	0.089	cfs	CBs #6-8

Hydrodynamic Separator #1 (HDS-1)

Total WQF =	0.90	cfs	CBs #1-8

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DRY POND 2

Catch Basin #9 (CB-9)

WQF = (qu) x (A) x (WQV)

WQV =	1.0	inches
Qu =	774.0	csm/in based on time of concentration of 6 minutes (0.1 hours) per table
A (impervious area) =	0.000255	sq mi
WQF =	0.197	cfs

Catch Basin #10 (CB-10)

WQF = (qu) x (A) x (WQV)

WQV =	1.0	inches
Qu =	774.0	csm/in based on time of concentration of 6 minutes (0.1 hours) per table
A (impervious area) =	0.000296	sq mi
WQF =	0.229	cfs

Catch Basin #11 (CB-11)

WQF = (qu) x (A) x (WQV)

WQV =	1.0	inches
Qu =	774.0	csm/in based on time of concentration of 6 minutes (0.1 hours) per table
A (impervious area) =	0.000291	sq mi
WQF =	0.225	cfs

Catch Basin #12 (CB-12)

WQF = (qu) x (A) x (WQV)

WQV =	1.0	inches	
Qu =	774.0	csm/in based on time of concentration of 6 minutes (0.1 hours) per table	
A (impervious area) =	0.000600	sq mi	
WQF =	0.464	cfs	
Total WQF =	1.116	cfs	CBs #9-12

Catch Basin #13 (CB-13)

WQF = (qu) x (A) x (WQV)

WQV =	1.0	inches
Qu =	774.0	csm/in based on time of concentration of 6 minutes (0.1 hours) per table
A (impervious area) =	0.000325	sq mi
WQF =	0.251	cfs

Catch Basin #14 (CB-14)

WQF = (qu) x (A) x (WQV)

WQV =	1.0	inches

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Qu =	774.0	csm/in based on time of concentration of 6 minutes (0.1 hours) per table	
A (impervious area) =	0.000291	sq mi	
WQF =	0.225	cfs	
Total WQF =	0.476	cfs	CBs #13-14

Catch Basin #15 (CB-15)

WQF = (qu) x (A) x (WQV)			
WQV =	1.0	inches	
Qu =	774.0	csm/in based on time of concentration of 6 minutes (0.1 hours) per table	
A (impervious area) =	0.000348	sq mi	
WQF =	0.269	cfs	
Total WQF =	0.746	cfs	CBs #13-15

Catch Basin #16 (CB-16)

WQF = (qu) x (A) x (WQV)			
WQV =	1.0	inches	
Qu =	774.0	csm/in based on time of concentration of 6 minutes (0.1 hours) per table	
A (impervious area) =	0.000587	sq mi	
WQF =	0.455	cfs	
Total WQF =	1.571	cfs	CBs #9-12, 16

Hydrodynamic Separator #2 (HDS-2)

Total WQF =	2.32	cfs	CBs #9-16

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Appendix G: TSS Removal

TSS Removal Calculation Worksheet

Location: Subcatchment P1

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Proprietary Pretreatment Practice (HDS-1)	**0.80**	**1.00**	**0.80**	**0.20**
Proprietary Treatment Practice (JFV-1)	**0.80**	**0.20**	**0.16**	**0.04**

Total TSS Removal = **96%**

Project: 296229
Prepared By: Arup
Date: 3/18/2025

*Equals remaining load from previous BMP (E) which enters the BMP

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TSS Removal Calculation Worksheet

Location: Subcatchment P2

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Proprietary Pretreatment Practice (HDS-2)	0.80	1.00	0.80	0.20
Proprietary Treatment Practice (JFV-2)	0.80	0.20	0.16	0.04

Total TSS Removal = 96%

Project: 296229
Prepared By: Arup
Date: 3/18/2025

*Equals remaining load from previous BMP (E) which enters the BMP

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6.6.2 Total Phosphorus

Total phosphorus and orthophosphate phosphorous (ortho phosphorous) were analyzed for 21 of the sampled storm events. These results are shown in Tables 13 and 14.

Influent EMCs for total phosphorus ranged from 0.0806 mg/L to 1.7500 mg/L with a mean of 0.4711 mg/L and a median of 0.3380 mg/L. Corresponding effluent EMCs for total phosphorus ranged from 0.030mg/L to 0.1730 mg/L with a mean of 0.0836 mg/L and a median of 0.0915 mg/L.

Influent EMCs for ortho phosphorous ranged from 0.0100 mg/L to 0.0360 mg/L with a mean of 0.0179 mg/L and a median of 0.0150 mg/L. Corresponding effluent EMCs for ortho phosphorous ranged from 0.0100 mg/L to 0.0541 mg/L with a mean of 0.0192 mg/L and a median of 0.0160 mg/L.

Table 13. Total Phosphorus Results

Total Phosphorus								
Event ID	Sample Type	Influent result (mg/L)	Method reporting limit (MRL) (mg/L)	Influent load (g)	Effluent result (mg/L)	Method reporting limit (MRL) (mg/L)	Effluent load (g)	Individual storm reduction (RE) (%)
4/7/2017	Comp.	0.7060	0.0100	44.3	0.0920	0.0100	5.8	87.0
4/12/2017	Comp.	0.3380	0.0100	33.0	0.0760	0.0100	7.4	77.5
4/19/2017	Comp.	0.5000	0.0100	9.0	0.0360	0.0100	0.7	92.8
4/26/2017	Comp.	0.5040	0.0100	22.0	0.0420	0.0100	1.8	91.7
5/13/2017	Comp.	0.2560	0.0100	25.0	0.1100	0.0100	10.7	57.0
5/16/2017	Comp.	0.0940	0.0100	16.3	0.0420	0.0100	7.3	55.3
6/8/2017	Comp.	0.2560	0.0100	22.9	0.1040	0.0100	9.3	59.4
6/15/2017	Comp.	0.3620	0.0100	37.6	0.0520	0.0100	5.4	85.6
3/8/2018	Comp.	1.7500	0.0100	163.1	0.1300	0.0100	12.1	92.6
3/14/2018	Comp.	0.6520	0.0100	69.7	0.0940	0.0100	10.1	85.6
3/16/2018	Comp.	0.0820	0.0100	1.8	0.0300	0.0100	0.7	63.4
3/22/2018	Comp.	0.3640	0.0100	40.9	0.0720	0.0100	8.1	80.2
3/27/2019	Comp.	0.2260	0.0500	39.5	0.0699	0.0500	12.2	69.1
4/5/2019	Peak	0.3370	0.0500	1.7	0.0915	0.0500	0.5	72.8
4/13/2019	Peak	0.2490	0.0500	95.9	0.0870	0.0500	33.5	65.1
5/18/2019	Peak	1.0900	0.2500	122.7	0.1730	0.0500	19.5	84.1
12/7/2019	Comp.	0.3350	0.0500	89.9	0.1050	0.0500	28.2	68.7
12/11/2019	Comp.	0.0806	0.0500	8.5	0.0523	0.0500	5.5	35.1
12/19/2019	Comp.	0.2110	0.0500	37.1	0.0925	0.0500	16.2	56.2
3/30/2020	Peak	1.0500	0.0500	126.0	0.0921	0.0500	11.1	91.2
4/20/2020	Peak	0.4510	0.0500	27.9	0.1120	0.0500	6.9	75.2
Min		0.0806	0.0100	1.7	0.0300	0.0100	0.5	35.1
Max		1.7500	0.2500	163.1	0.1730	0.0500	33.5	92.8
Mean		0.4711	0.0367	49.3	0.0836	0.0271	10.1	73.6
Median		0.3380	0.0100	37.1	0.0915	0.0100	8.1	75.2
Sum				1034.9			213.0	

Table 21. Basic Treatment TSS results

Total Suspended Solids (TSS)									
Event ID	Sample Type	Influent result (mg/L)	Method reporting limit (MRL) (mg/L)	Influent load (kg)	Effluent result (mg/L)	Method reporting limit (MRL) (mg/L)	Effluent load (kg)	Basic Criteria 1 20-100 mg/l Eff. conc. ≤ 20mg/l	Basic Criteria 2 100-200 mg/l ≥80% RE (%) [a]
3/20/2017	Comp.	51.2	2.0	6.8	19.4	2.1	2.6	19.4	
3/21/2017	Comp.	102.0	2.0	7.1	22.0	2.0	1.5		78.4
4/7/2017	Comp.	201.0	2.0	12.6	30.8	2.0	1.9		84.6
4/12/2017	Comp.	108.0	2.0	10.6	24.4	2.0	2.4		77.4
4/19/2017	Comp.	452.0	2.0	8.2	44.6	2.1	0.8		77.7
4/26/2017	Comp.	257.0	2.3	11.2	10.0	2.4	0.4		95.0
5/13/2017	Comp.	66.0	2.0	6.4	33.2	2.0	3.2	33.2	
5/16/2017	Comp.	24.0	2.0	4.2	6.8	2.0	1.2	6.8	
6/8/2017	Comp.	73.6	2.0	6.6	16.8	2.0	1.5	16.8	
6/15/2017	Comp.	134.0	2.5	13.9	10.4	2.0	1.1		92.2
3/8/2018	Comp.	755.0	3.3	70.4	47.2	2.0	4.4		76.4
3/14/2018	Comp.	181.0	5.0	19.4	27.0	5.0	2.9		85.1
3/16/2018	Comp.	19.0	5.0	0.4	ND	5.0	0.1		
3/22/2018	Comp.	224.0	5.0	25.1	20.0	5.0	2.2		90.0
3/27/2019	Comp.	94.0	5.0	16.4	11.0	5.0	1.9	11.0	
4/5/2019	Peak	171.0	5.0	0.9	23.0	5.0	0.1		86.5
4/13/2019	Peak	117.0	5.0	45.0	25.0	5.0	9.6		78.6
5/18/2019	Peak	254.0	5.0	28.6	20.0	5.0	2.3		90.0
12/7/2019	Comp.	200.0	5.0	53.7	17.0	5.0	4.6		91.5
12/11/2019	Comp.	13.0	5.0	1.4	10.0	5.0	1.1		
12/19/2019	Comp.	91.0	5.0	16.0	31.0	5.0	5.4	31.0	
3/30/2020	Peak	605.0	5.0	72.6	51.0	5.0	6.1		74.5
4/20/2020	Peak	210.0	5.0	13.0	29.0	5.0	1.8		85.5
Min		13.0	2.0	0.4	5.0	2.0	0.1	6.8	74.5
Max		755.0	5.0	72.6	51.0	5.0	9.6	33.2	95.0
Mean		191.4	3.7	19.6	23.2	3.6	2.6	19.7	84.2
Median		134.0	5.0	12.6	22.0	5.0	1.9	18.1	85.1
Lower 95% for RE [b]									82.0
Sum				450.4			59.2		

[a] Influent TSS concentrations capped at 200 mg/L for Basic Criteria 2 RE calculation purposes
[b] confidence interval calculated using TAPE bootstrap confidence interval calculator

WASHINGTON STATE DEPARTMENT OF ECOLOGY

January 2021

GENERAL USE LEVEL DESIGNATION FOR BASIC (TSS) AND PHOSPHORUS TREATMENT For Contech Environmental Solutions Jellyfish® Filter

Ecology's Decision:

1. Based on Contech Environmental Solution's application submissions, Ecology hereby issues a General use level designation (GULD) for Basic (TSS) and Phosphorus Treatment for Contech's Jellyfish® Filter:
   - Sized at a hydraulic loading rate of no greater than 0.21 gpm/sf filter surface for hi-flo cartridges and 0.11 gpm/sf filter surface for draindown cartridges

Table 1. Jellyfish® cartridge hydraulic loading rates and sediment capture capacity[1] associated with various filter cartridge sizes.

Cartridge Length	Design Treatment Flow Rate	Design Sediment Mass Loading Capacity
15 inches	Hi-Flo 22 gpm Draindown 11 gpm	Hi-Flo 35 lbs Draindown 17 lbs
27 inches	Hi-Flo 40 gpm Draindown 20 gpm	Hi-Flo 63 lbs Draindown 31 lbs
40 inches	Hi-Flo 60 gpm Draindown 30 gpm	Hi-Flo 93 lbs Draindown 46 lbs
54 inches	Hi-Flo 80 gpm Draindown 40 gpm	Hi-Flo 125 lbs Draindown 63 lbs

[1] Design sediment mass loading capacity based on laboratory testing using silica sediment.

2. Ecology approves Jellyfish® Filter units at the design treatment flow rates shown in Table 1. Total Jellyfish Filter system design treatment capacity is the sum of the design treatment capacity of individual cartridges and must equal or exceed the water quality design flow rate. Calculate the water quality design flow rate that must be treated by an individual treatment system using the following procedures:
    - Western Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using the latest version of the Western Washington Hydrology Model or other Ecology-approved continuous runoff model.
    - Eastern Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using one of the three methods described in Chapter 2.7.6 of the 2019 Stormwater Management Manual for Eastern Washington (SWMMEW) or local manual.
    - Entire State: For treatment installed downstream of detention, the water quality design flow rate is the full 2-year release rate of the detention facility.
3. The GULD has no expiration date but may be amended or revoked by Ecology.

Ecology's Conditions of Use:

Jellyfish® Filter units shall comply with the following conditions:

1. Design, assemble, install, operate, and maintain Jellyfish® Filter units in accordance with Contech's applicable manuals and documents and this Ecology Decision.
2. Contech uses sediment-loading capacity, in conjunction with the water quality design flow rate, to determine the target maintenance interval.
3. Jellyfish® Filters shall conform to specifications submitted to and approved by Ecology.
4. Maintenance: The required inspection/maintenance interval for stormwater treatment devices is often dependent on the efficiency of the device and the degree of pollutant loading from a particular drainage basin. Therefore, Ecology does not endorse or recommend a "one size fits all" maintenance cycle for a particular model/size of manufactured filter treatment device.
    - The Jellyfish® Filter is designed for a target maintenance interval of 12 months. Maintenance includes floatable trash, debris, and oil removal; sediment removal; and the rinsing or replacement of filter cartridges.
    - A Jellyfish® Filter tested in Dundee, OR averaged a 3.2 month maintenance interval. Construction activities were ongoing in the drainage basin and near the monitoring site during the first two years of the study. Monitoring personnel observed significant amounts of roadway sediments and organic debris in the runoff, and TSS concentrations were higher than typical for roadway runoff. The runoff that occurred during the study may be unusual, and the maintenance interval the Jellyfish® Filter required may not be indicative of other, more typical, sites.

- Owner/s operators must inspect Jellyfish® Filter systems for a minimum of twelve months from the start of post-construction operation to determine site-specific inspection/maintenance schedules and requirements. Owners/operators must conduct inspections monthly during the wet season, and every other month during the dry season. (According to the SWMMWW, the wet season in westerns Washington is October 1 to April 30. According to the SWMMEW, the wet season in eastern Washington is October 1 to June 30.) After the first year of operation, owners/operators must conduct inspections based on the findings during the first year of inspections.
- Conduct inspections by qualified personnel, follow manufacturer's guidelines, and use methods capable of determining either a decrease in treated effluent flow rate and/or a decrease in pollutant removal ability.

5. Install the Jellyfish® Filter in such a manner such that flows exceeding the maximum operating rate of the system are bypassed and will not resuspend captured sediment.
6. Discharges from the Jellyfish® Filter units shall not cause or contribute to water quality standards violations in receiving waters.

Applicant: CONTECH Engineered Solutions

Applicant's Address: 11835 NE Glenn Widing Dr
Portland, OR 97220

Application Documents:

- *Jellyfish® Filter Dundee, OR, General Use Level Designation Technical Evaluation Report*, Prepared by CONTECH Engineered Solutions, December 28, 2020
- Application Letter for CULD for Jellyfish Filter - Basic Treatment, Phosphorus Treatment, and Oil Treatment, dated April 27, 2012.
- Letter from Imbrium Systems dated September 4, 2012 regarding the draft CULD/PULD document.
- *TAPE Analysis of Jellyfish Filter UF Field Study Data*, prepared by Stormwater Management Services, LLC.
- *TARP Field Test Performance Monitoring of a Jellyfish Filter JF4-2-1. Performance Monitoring Report for JF4-2-1* Prepared By: University of Florida, Engineering School of Sustainable Infrastructure and Environment (ESSIE), University of Florida, Gainesville, FL 32611. Final Version: 01 November 2011.
- *Jellyfish Filter Systems Evaluation Report in Consideration for Pilot Level Designation (PLD) for Imbrium Systems Corporation*, by Gary R. Minton, PhD, PE, with Resource Planning Associates in Seattle, Washington May 7, 2008 (updated July 1, 2008).

- *NJCAT Technology Verification, Jellyfish Fine Sediment Filter*, by the New Jersey Corporation for Advanced Technology (NJCAT) Program Imbrium Systems Corporation, June 2008

Applicant's Use Level Request:

- General use level designation as a Basic (TSS) and Phosphorus Treatment device in accordance with Ecology's 2019 Stormwater Management Manual for Western Washington.

Applicant's Performance Claims:

Based on results from a laboratory and field-testing, the applicant claims the Jellyfish® Filter, operating at a hydraulic loading rate of no more than 0.21 gpm/sf for hi-flo cartridges and 0.11 gpm/sf for draindown cartridges, is able to remove:

- 80% of total suspended solids (TSS) for influent concentrations greater than 100 mg/L and achieve a 20 mg/L effluent for influent concentrations less than 100 mg/L.
- 50% of total phosphorus for influent concentrations 0.1 to 0.5 mg/L

Recommendations:

Ecology finds that:

- Contech Engineered Solutions has shown Ecology, through laboratory and field testing, that the Jellyfish® Filter is capable of attaining Ecology's Basic (TSS) and Total Phosphorus treatment goals.

Findings of Fact:

<u>Field Testing 2017-2020</u>
Contech completed field testing in Dundee, OR on a Jellyfish® Filter unit containing six 54-inch hi-flo cartridges and one 54-inch draindown cartridge. This combination of cartridges resulted in a design flow capacity of 520 gpm (1.16 cfs). Since Contech conducted the field evaluation they contracted with Herrera Environmental Consultants to provide third party oversight.

- The field evaluation was completed between March 2017 and April 2020. Throughout the evaluation a total of 23 individual storm events (18 flow-weighted composite samples and 5 peak flow grab samples) were sampled to evaluate system performance. All sampled events met the TAPE sampling event qualification criteria, while 21 of the 23 events met the influent requirements for TSS and/or total phosphorus. Peak flows during these 21 events ranged from 26% to 106% of the design treatment capacity of 520 gpm, with a mean peak flow rate of 67% of design.
- Of the 23 TAPE qualified events, 21 met the requirements for TSS analysis (16 flow weighted composite; 5 peak flow grab samples). Influent concentrations ranged from 24 mg/L to 755 mg/L, with a mean concentration of 208 mg/L. Concentrations that exceeded the upper end of TAPE influent range were capped at 200 mg/L prior to calculating the pollutant removal efficiency. For all samples with influent concentrations greater than 100 mg/L the bootstrap estimate of the lower 95 percent confidence limit (LCL95) of the mean TSS reduction was 82%, meeting the 80% performance goal for Basic Treatment. The TAPE bootstrap calculator could not be used on samples with influent concentrations

between 20 mg/L to 100 mg/L due to the limited number of events available (n=6). For these events the mean and median effluent TSS concentrations were 19.7 and 18.1 mg/L respectively, again meeting the 20 mg/L effluent goal for Basic Treatment.

- Of the 23 TAPE qualified events, 18 met the requirements for total phosphorus analysis (13 flow-weighted composite; 5 peak flow grab samples). Influent concentrations ranged from 0.211 mg/L to 1.75 mg/L, with a mean concentration of 0.535 mg/L. Concentrations that exceeded the upper end of TAPE influent range were capped at 0.5 mg/L prior to calculating the pollutant removal efficiency. The LCL 95 mean percent removal goal was 70.1%, meeting the 50% performance goal for Phosphorus Treatment.
- Median particle sized distribution results from three samples showed 20% of sediment >250 µm, 31% of sediment between 62.5 to 250 µm, and 51% of sediment <62.5 µm. This demonstrates the influent to the Jellyfish consisted of primarily silt-sized particles (3.9 to 62.5 µm) and is thus representative of Pacific Northwest Stormwater.
- Contech encountered several unanticipated events and challenges that disrupted the sampling and/or resulted in lost data: the Jellyfish was taken offline twice to avoid atypical sediment loading that was the result of construction within the drainage basin; monitoring was suspended to repair or replace equipment that was damaged from vandalism and extreme weather; and, a cyber-attack on Contech storage drives resulted in a loss of approximately 15% of non-sampled flow and precipitation data.

Field Testing 2010-2011

Results (second-generation membrane filtration cartridges) – University of Florida (Gainesville, FL) installed and tested a Jellyfish JF4-2-1. The University conducted monitoring of the system from May 28, 2010 to June 27, 2011, with runoff from 15.01 inches of rainfall. The monitoring followed the Technology Acceptance Reciprocity Partnership (TARP) field test protocol, per the guidelines of the New Jersey Department of Environmental Projection (NJDEP). The New Jersey Corporation for Advanced Technology (NJCAT), on May 14, 2012 certified the Jellyfish Filter for 80 percent TSS removal.

- The JF4-2-1 operating at a maximum treatment flow rate of 200 gpm provided a median total suspended solids (TSS) removal of 89 percent, and a median suspended sediment concentration (SSC) removal of 99 percent. Influent TSS concentrations ranged from 16.3 to 261.0 mg/L. TSS concentrations in the range of 20-100 mg/L were reduced to less than 20 mg/L for 16 of 17 events. Average TSS removal for influent TSS between 100-200 mg/L was 90 percent.
- Other median pollutant removals included: total phosphorus, 59 percent; total nitrogen, 51 percent; total copper, 90 percent; and total zinc 70 percent.
- Total oil and grease influent concentrations ranged from 0.2 to 4.1 mg/L, with a median removal efficiency of 62 percent.
- No maintenance was required or carried out during the 13-month monitoring period. Curves of head loss versus flow rate were nearly identical for the system with fresh cartridges (beginning of monitoring) and dirty cartridges (end of monitoring period). The sump and filter cartridges captured 166 pounds of dry basis particulate matter.

- Runoff treated by the JF4-2-1 was from a nearby parking lot (approximately 75 percent pavement and 25 percent planting islands). Depending on storm event intensity and wind direction, the drainage area varied from 0.12 to 0.20 acres.

Laboratory Testing and Results

Imbrium conducted testing at the Monteco Limited Research & Development Centre (RDC) in Mississauga, Ontario with third party testing oversight provided by Prof. James Li of Ryerson University in Toronto. The laboratory set-up used a single cartridge fitted into a tank sized to be 1/7 the volume of a full-scale 7-cartridge Jellyfish Filter system. Based on the lab test results:

- A Jellyfish Filter system fitted with a single Jellyfish cartridge or multiple Jellyfish cartridges can remove greater than 86% Sil-Co-Sil 106 (mean particle size 22 microns) within a 95% confidence interval of +/- 1.3% at the system's 100% operating rate with influent sediment concentrations ranging from 100 to 300 mg/L. For systems using 12-inch diameter cartridges, each cartridge containing 91filtration tentacles of 54-inch length, the 100% operating rate is 50 gpm per cartridge operating at 12 inches driving head (i.e., 0.66 gpm/ft2). Each (of the) 91 filtration tentacles is composed of three 18-inch long segments for a total length of 54 inches with 76 ft2 of surface area (first generation membrane filtration cartridges).
- Test runs at 100 mg/L influent concentration resulted in effluent concentrations ranging from 12 to 21 mg/L. Ten of the 11 test runs had effluent less than 20 mg/L (as required for Basic Treatment).
- Sampling of effluent found an average D90 of about 14 microns indicating the Jellyfish Filter System is capable of removing most particles above 15 microns.

Other Jellyfish Filter Related Issues Recommended to be Addressed by the Company:

1. Conduct hydraulic testing to obtain information about maintenance requirements on a site with runoff that is more typical of the Pacific Northwest.

Technology Description: Download at: http://www.conteches.com/products/stormwater-management/treatment/jellyfish-filter

Contact Information:

Applicant: Jeremiah Lehman
Contech Engineered Solutions, LLC.
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(503) 258-3136
jlehman@conteches.com

Applicant website: www.conteches.com

Ecology web link: http://www.ecy.wa.gov/programs/wq/stormwater/newtech/index.html

Ecology: Douglas C. Howie, P.E.
Department of Ecology
Water Quality Program
(360) 407-6444
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Revision History

Date	Revision
August 2008	PULD granted
January 2012	PULD Extension granted
September 2012	CULD for Basic treatment; PULD for Oil and Phosphorus treatment.
January 2013	Modifications to format document in line with other Use Level Documents, Changes dates for QAPP, TER, and Expiration
August 2014	Revised contact information and due dates for QAPP, TER, and expiration
March 2015	Revised Contact Information to Contech from Imbrium
November 2016	Revised Contech contact information
March 2018	Revised TER delivery and Expiration dates, Changed text from Imbrium to Contech in selected locations
April 2019	Revised TER delivery and Expiration dates
September 2020	Revised TER delivery and Expiration dates
January 2021	GULD Granted

Estimated Net Annual Solids Load Reduction
Based on the Rational Rainfall Method

CONTECH ENGINEERED SOLUTIONS

CASCADE separator™

ZOVL - Moraga Storage
Oakham, MA
HDS 2

AREA	4.02	acres	CASCADE MODEL	CS-6	
WEIGHTED C	0.48		PARTICLE SIZE	110	microns
TC	6.00	minutes			

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Hydraulic Loading Rate (gpm/ft2)	Removal Efficiency (%)	Incremental Removal (%)
0.08	37.6%	2.45	100.0	37.6
0.16	22.6%	4.90	100.0	22.6
0.24	11.9%	7.35	100.0	11.9
0.32	7.6%	9.80	100.0	7.6
0.40	4.3%	12.25	100.0	4.3
0.48	2.3%	14.70	98.1	2.3
0.56	1.8%	17.15	95.8	1.7
0.64	1.4%	19.60	93.5	1.3
0.72	0.9%	22.05	91.2	0.8
0.80	1.2%	24.50	88.9	1.0
0.88	1.5%	26.96	86.6	1.3
0.96	0.9%	29.41	84.3	0.8
1.04	0.4%	31.86	82.0	0.3
1.12	0.4%	34.31	79.7	0.3
1.20	0.6%	36.76	77.3	0.4
1.28	0.3%	39.21	75.0	0.2
1.36	0.2%	41.66	72.7	0.1
1.44	0.9%	44.11	70.4	0.6
1.52	0.6%	46.56	68.1	0.4
1.60	0.4%	49.01	65.8	0.3
1.80	0.2%	55.14	60.1	0.1
2.00	0.9%	61.26	54.3	0.5
				96.6
			Removal Efficiency Adjustment[2] =	0.0%
			Predicted % Annual Rainfall Treated =	98.8%
			Predicted Net Annual Load Removal Efficiency =	96.6%

1 - Based on 13 years of 15 minute precipitation data for Station 0666, Birch Hill Dam, Worcester County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

Estimated Net Annual Solids Load Reduction
Based on the Rational Rainfall Method

CONTECH ENGINEERED SOLUTIONS

CASCADE separator™

ZOVL - Moraga Storage
Oakham, MA
HDS 1

AREA	2.02	acres	CASCADE MODEL	CS-4	
WEIGHTED C	0.50		PARTICLE SIZE	110	microns
TC	6.00	minutes			

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Hydraulic Loading Rate (gpm/ft2)	Removal Efficiency (%)	Incremental Removal (%)
0.08	37.6%	2.89	100.0	37.6
0.16	22.6%	5.77	100.0	22.6
0.24	11.9%	8.66	100.0	11.9
0.32	7.6%	11.54	100.0	7.6
0.40	4.3%	14.43	98.3	4.3
0.48	2.3%	17.32	95.6	2.2
0.56	1.8%	20.20	92.9	1.7
0.64	1.4%	23.09	90.2	1.2
0.72	0.9%	25.97	87.5	0.8
0.80	1.2%	28.86	84.8	1.0
0.88	1.5%	31.75	82.1	1.2
0.96	0.9%	34.63	79.3	0.7
1.04	0.4%	37.52	76.6	0.3
1.12	0.4%	40.40	73.9	0.3
1.20	0.6%	43.29	71.2	0.4
1.28	0.3%	46.17	68.5	0.2
1.36	0.2%	49.06	65.8	0.1
1.44	0.9%	51.95	63.1	0.6
1.52	0.6%	54.83	60.4	0.3
1.60	0.4%	57.72	57.6	0.2
1.80	0.2%	64.93	50.9	0.1
2.00	0.9%	72.15	44.1	0.4
				95.8
			Removal Efficiency Adjustment[2] =	0.0%
			Predicted % Annual Rainfall Treated =	98.8%
			Predicted Net Annual Load Removal Efficiency =	95.8%

1 - Based on 13 years of 15 minute precipitation data for Station 0666, Birch Hill Dam, Worcester County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

Appendix H: BMP Sizing

Moraga Storage LLC - ZOVL
358 Coldbrook Road
Oakham, MA
Arup Job Number: 296229
March 18, 2025

Basin Sizing Calculations

Basin: Pond1

Basin Requirements:
Percentage of WQV Required for New Development = 100%
Total Impervious Area = 44,339 SF
Required WQV = 1" x Impervious Area = 3,695 CF
Areq = Surface area required for bottom of basin = 0.066 * required WQV = 244 SF

Proposed Basin Size:
Bottom of basin surface area = 6,139 SF
1ft depth area = 7,523 SF
2ft depth area = 8,975 SF
3ft depth area = 10,478 SF
Top of basin surface area = 12,037 SF
A = Average surface area top and bottom of basin = 9,088 SF
Dponding = ponding depth = 3 FT
V = Static storage volume = A * Dponding = 27,264 CF

Basin: Pond2

Basin Requirements:
Percentage of WQV Required for New Development = 100%
Total Impervious Area = 83,027 SF
Required WQV = 1" x Impervious Area = 6,919 CF
Areq = Surface area required for bottom of basin = 0.066 * required WQV = 457 SF

Proposed Basin Size:
Bottom of basin surface area = 3,429 SF
1ft depth area = 4,209 SF
2ft depth area = 5,080 SF
3ft depth area = 6,015 SF
4ft depth area = 7,019 SF
Top of basin surface area = 8,092 SF
A = Average surface area top and bottom of basin = 5,761 SF
Dponding = ponding depth = 4 FT
V = Static storage volume = A * Dponding = 23,042 CF

Appendix H: BMP Sizing

Moraga Storage LLC - ZOVL
358 Coldbrook Road
Oakham, MA
Arup Job Number: 296229
March 18, 2025

Basin Sizing Calculations

Basin: Pond1

Basin Requirements:
Percentage of WQV Required for New Development = 100%
Total Impervious Area = 44,339 SF
Required WQV = 1" x Impervious Area = 3,695 CF
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Proposed Basin Size:
Bottom of basin surface area = 6,139 SF
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Top of basin surface area = 12,037 SF
A = Average surface area top and bottom of basin = 9,088 SF
Dponding = ponding depth = 3 FT
V = Static storage volume = A * Dponding = 27,264 CF

Basin: Pond2

Basin Requirements:
Percentage of WQV Required for New Development = 100%
Total Impervious Area = 83,027 SF
Required WQV = 1" x Impervious Area = 6,919 CF
Areq = Surface area required for bottom of basin = 0.066 * required WQV = 457 SF

Proposed Basin Size:
Bottom of basin surface area = 3,429 SF
1ft depth area = 4,209 SF
2ft depth area = 5,080 SF
3ft depth area = 6,015 SF
4ft depth area = 7,019 SF
Top of basin surface area = 8,092 SF
A = Average surface area top and bottom of basin = 5,761 SF
Dponding = ponding depth = 4 FT
V = Static storage volume = A * Dponding = 23,042 CF

Appendix I: Pre & Post Development SSA Model Outputs

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.0.94 (Build 0)

****
Project Description
****
File Name ..... ZOVL_PreDevelopment_r2.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. SCS TR-20
Time of Concentration..... SCS TR-55
Storage Node Exfiltration.. Constant rate, projected area
Starting Date MAY-06-2024 00:00:00
Ending Date MAY-09-2024 00:00:00
Report Time Step 00:04:00

****
Element Count
****
Number of rain gages 1
Number of subbasins 2
Number of nodes 2
Number of links 0

****
Raingage Summary
****

Gage ID	Data Source	Data Type	Recording Interval min
Rain Gage-01	2YR 24HR (Future)	CUMULATIVE	1.00

****
Subbasin Summary
****

Subbasin ID	Total Area ft²
Catch-E1	249040.01
Catch-E2	376753.49

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
DP-1	OUTFALL	0.00	0.00	0.00	
DP-2	OUTFALL	0.00	0.00	0.00	

********** Runoff Quantity Continuity **********	Volume acre-ft	Depth inches
Total Precipitation	4.612	3.852
Surface Runoff	0.011	0.009

Continuity Error (%) ..... -0.001

Flow Routing Continuity	Volume acre-ft	Volume Mgallons
External Inflow	0.000	0.000
External Outflow	2.622	0.855
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

Composite Curve Number Computations Report

Subbasin Catch-E1

Soil/Surface Description	Area (ft²)	Soil Group	CN
Woods, Fair	142163.41	D	79.00
Paved parking & roofs	5256.97	D	98.00
Dirt roads	101619.58	D	89.00
Composite Area & Weighted CN	249039.97		83.48

Subbasin Catch-E2

Soil/Surface Description	Area (ft²)	Soil Group	CN
Woods & grass combination, Fair	349096.58	D	82.00
Dirt roads	27656.87	D	89.00
Composite Area & Weighted CN	376753.45		82.51

SCS TR-55 Time of Concentration Computations Report

Sheet Flow Equation

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where:

Tc = Time of Concentration (hrs)
n = Manning's Roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's Roughness

Subbasin Catch-E1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.30	0.80	0.80
Flow Length (ft):	40.00	35.00	25.00
Slope (%):	7.50	6.00	12.00
2 yr, 24 hr Rainfall (in):	3.00	3.00	3.00
Velocity (ft/sec):	0.13	0.05	0.07
Computed Flow Time (minutes):	4.99	10.74	6.22

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	384.00	264.00	61.00
Slope (%):	9.50	3.00	3.50
Surface Type:	Woodland	Woodland	Unpaved
Velocity (ft/sec):	1.54	0.87	3.02
Computed Flow Time (minutes):	4.16	5.06	0.34
Total TOC (minutes):	31.50		

Subbasin Catch-E2

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.80	0.80
Flow Length (ft):	39.00	25.00	37.00
Slope (%):	11.00	16.00	25.00
2 yr, 24 hr Rainfall (in):	3.00	3.00	3.00
Velocity (ft/sec):	0.07	0.08	0.10
Computed Flow Time (minutes):	9.19	5.54	6.35

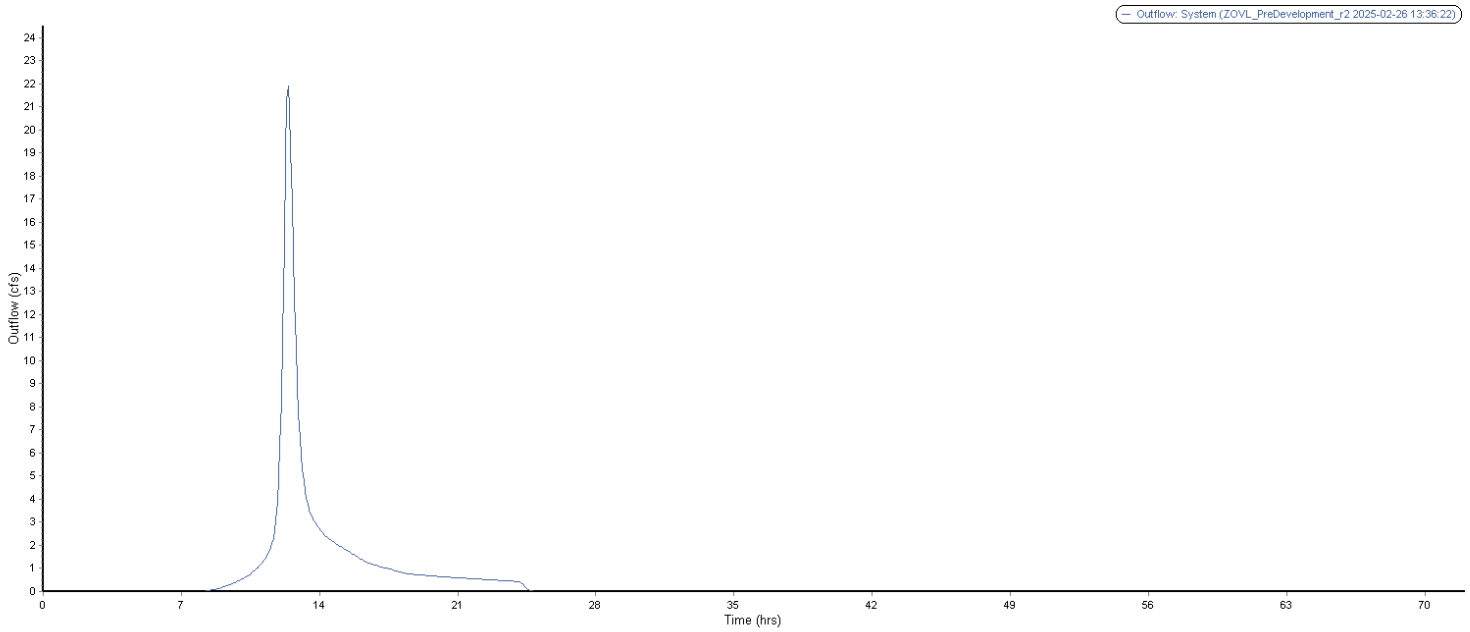
Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	21.00	170.00	232.00
Slope (%):	14.50	5.00	5.00
Surface Type:	Woodland	Unpaved	Woodland
Velocity (ft/sec):	1.90	3.61	1.12
Computed Flow Time (minutes):	0.18	0.78	3.45
Total TOC (minutes):	25.51		

****
Subbasin Runoff Summary
****

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days	hh:mm:ss
Catch-E1	3.90	2.24	8.51	83.480	0	00:31:30
Catch-E2	3.90	2.16	13.60	82.510	0	00:25:30

Analysis began on: Wed Feb 26 13:26:04 2025
Analysis ended on: Wed Feb 26 13:26:13 2025
Total elapsed time: 00:00:09


Outflow: System (ZOVL_PreDevelopment_r2 2025-02-26 13:36:22)
Outflow (cfs)
Time (hrs)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
0
7
14
21
28
35
42
49
56
63
70

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.0.94 (Build 0)

****
Project Description
****
File Name ..... ZOVL_PreDevelopment_r2.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. SCS TR-20
Time of Concentration..... SCS TR-55
Storage Node Exfiltration.. Constant rate, projected area
Starting Date MAY-06-2024 00:00:00
Ending Date MAY-09-2024 00:00:00
Report Time Step 00:04:00

****
Element Count
****
Number of rain gages 1
Number of subbasins 2
Number of nodes 2
Number of links 0

****
Raingage Summary
****

Gage ID	Data Source	Data Type	Recording Interval min
Rain Gage-01	10YR 24HR (Future)	CUMULATIVE	1.00

****
Subbasin Summary
****

Subbasin ID	Total Area ft²
Catch-E1	249040.01
Catch-E2	376753.49

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
DP-1	OUTFALL	0.00	0.00	0.00	
DP-2	OUTFALL	0.00	0.00	0.00	

********** Runoff Quantity Continuity **********	Volume acre-ft	Depth inches
Total Precipitation	7.096	5.927
Surface Runoff	0.020	0.017

Continuity Error (%) ..... -0.001

Flow Routing Continuity	Volume acre-ft	Volume Mgallons
External Inflow	0.000	0.000
External Outflow	4.883	1.591
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

Composite Curve Number Computations Report

Subbasin Catch-E1

Soil/Surface Description	Area (ft²)	Soil Group	CN
Woods, Fair	142163.41	D	79.00
Paved parking & roofs	5256.97	D	98.00
Dirt roads	101619.58	D	89.00
Composite Area & Weighted CN	249039.97		83.48

Subbasin Catch-E2

Soil/Surface Description	Area (ft²)	Soil Group	CN
Woods & grass combination, Fair	349096.58	D	82.00
Dirt roads	27656.87	D	89.00
Composite Area & Weighted CN	376753.45		82.51

SCS TR-55 Time of Concentration Computations Report

Sheet Flow Equation

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where:

Tc = Time of Concentration (hrs)
n = Manning's Roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's Roughness

Subbasin Catch-E1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.30	0.80	0.80
Flow Length (ft):	40.00	35.00	25.00
Slope (%):	7.50	6.00	12.00
2 yr, 24 hr Rainfall (in):	3.00	3.00	3.00
Velocity (ft/sec):	0.13	0.05	0.07
Computed Flow Time (minutes):	4.99	10.74	6.22

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	384.00	264.00	61.00
Slope (%):	9.50	3.00	3.50
Surface Type:	Woodland	Woodland	Unpaved
Velocity (ft/sec):	1.54	0.87	3.02
Computed Flow Time (minutes):	4.16	5.06	0.34
Total TOC (minutes):	31.50		

Subbasin Catch-E2

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.80	0.80
Flow Length (ft):	39.00	25.00	37.00
Slope (%):	11.00	16.00	25.00
2 yr, 24 hr Rainfall (in):	3.00	3.00	3.00
Velocity (ft/sec):	0.07	0.08	0.10
Computed Flow Time (minutes):	9.19	5.54	6.35

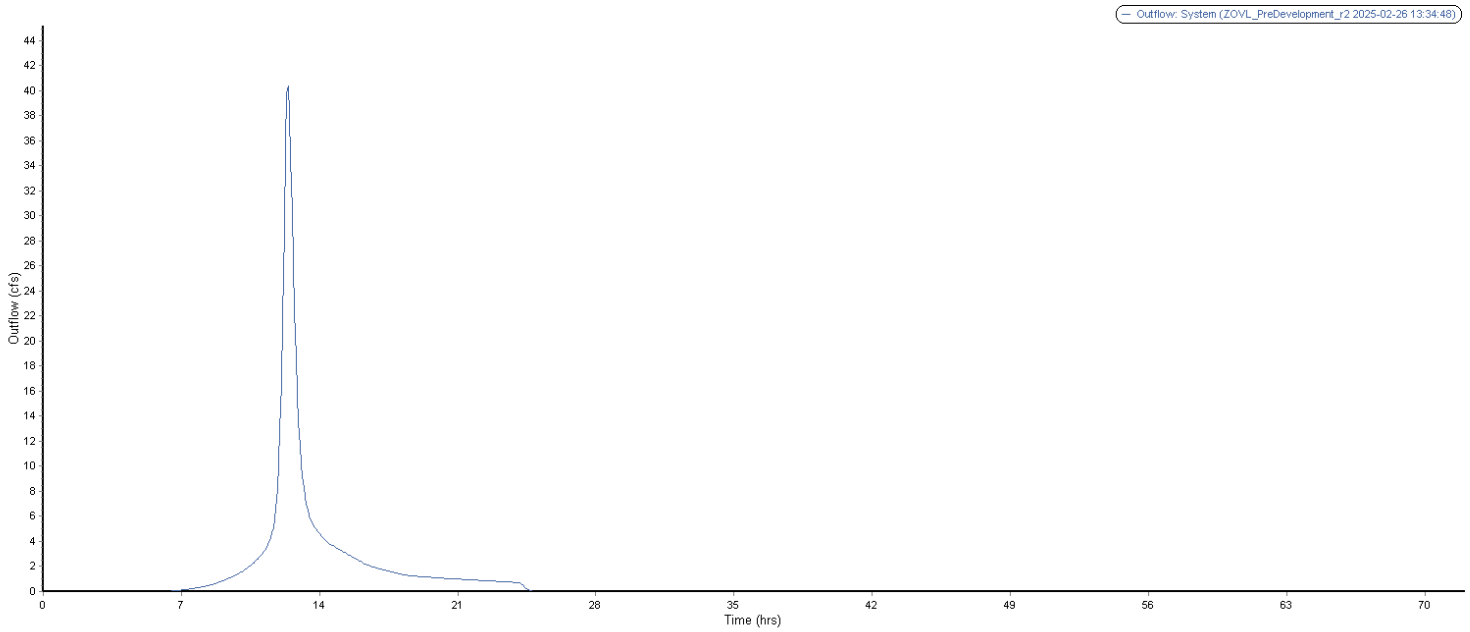
Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	21.00	170.00	232.00
Slope (%):	14.50	5.00	5.00
Surface Type:	Woodland	Unpaved	Woodland
Velocity (ft/sec):	1.90	3.61	1.12
Computed Flow Time (minutes):	0.18	0.78	3.45
Total TOC (minutes):	25.51		

****
Subbasin Runoff Summary
****

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days	hh:mm:ss
Catch-E1	6.00	4.14	15.58	83.480	0	00:31:30
Catch-E2	6.00	4.04	25.27	82.510	0	00:25:30

Analysis began on: Wed Feb 26 13:27:07 2025
Analysis ended on: Wed Feb 26 13:27:16 2025
Total elapsed time: 00:00:09


Outflow: System (ZOVL_PreDevelopment_r2 2025-02-26 13:34:48)
Outflow (cfs)
Time (hrs)
0
2
4
6
8
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12
14
16
18
20
22
24
26
28
30
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34
36
38
40
42
44
0
7
14
21
28
35
42
49
56
63
70

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.0.94 (Build 0)

****
Project Description
****
File Name ..... ZOVL_PreDevelopment_r2.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. SCS TR-20
Time of Concentration..... SCS TR-55
Storage Node Exfiltration.. Constant rate, projected area
Starting Date MAY-06-2024 00:00:00
Ending Date MAY-09-2024 00:00:00
Report Time Step 00:04:00

****
Element Count
****
Number of rain gages 1
Number of subbasins 2
Number of nodes 2
Number of links 0

****
Raingage Summary
****

Gage ID	Data Source	Data Type	Recording Interval min
Rain Gage-01	100YR 24HR (Future)	CUMULATIVE	1.00

****
Subbasin Summary
****

Subbasin ID	Total Area ft²
Catch-E1	249040.01
Catch-E2	376753.49

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
DP-1	OUTFALL	0.00	0.00	0.00	
DP-2	OUTFALL	0.00	0.00	0.00	

Runoff Quantity Continuity	Volume acre-ft	Depth inches
Total Precipitation	11.117	9.286
Surface Runoff	0.036	0.030

Continuity Error (%) ..... -0.001

Flow Routing Continuity	Volume acre-ft	Volume Mgallons
External Inflow	0.000	0.000
External Outflow	8.748	2.851
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

Composite Curve Number Computations Report

Subbasin Catch-E1

Soil/Surface Description	Area (ft²)	Soil Group	CN
Woods, Fair	142163.41	D	79.00
Paved parking & roofs	5256.97	D	98.00
Dirt roads	101619.58	D	89.00
Composite Area & Weighted CN	249039.97		83.48

Subbasin Catch-E2

Soil/Surface Description	Area (ft²)	Soil Group	CN
Woods & grass combination, Fair	349096.58	D	82.00
Dirt roads	27656.87	D	89.00
Composite Area & Weighted CN	376753.45		82.51

SCS TR-55 Time of Concentration Computations Report

Sheet Flow Equation

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where:

Tc = Time of Concentration (hrs)
n = Manning's Roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's Roughness

Subbasin Catch-E1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.30	0.80	0.80
Flow Length (ft):	40.00	35.00	25.00
Slope (%):	7.50	6.00	12.00
2 yr, 24 hr Rainfall (in):	3.00	3.00	3.00
Velocity (ft/sec):	0.13	0.05	0.07
Computed Flow Time (minutes):	4.99	10.74	6.22

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	384.00	264.00	61.00
Slope (%):	9.50	3.00	3.50
Surface Type:	Woodland	Woodland	Unpaved
Velocity (ft/sec):	1.54	0.87	3.02
Computed Flow Time (minutes):	4.16	5.06	0.34
Total TOC (minutes):	31.50		

Subbasin Catch-E2

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.80	0.80
Flow Length (ft):	39.00	25.00	37.00
Slope (%):	11.00	16.00	25.00
2 yr, 24 hr Rainfall (in):	3.00	3.00	3.00
Velocity (ft/sec):	0.07	0.08	0.10
Computed Flow Time (minutes):	9.19	5.54	6.35

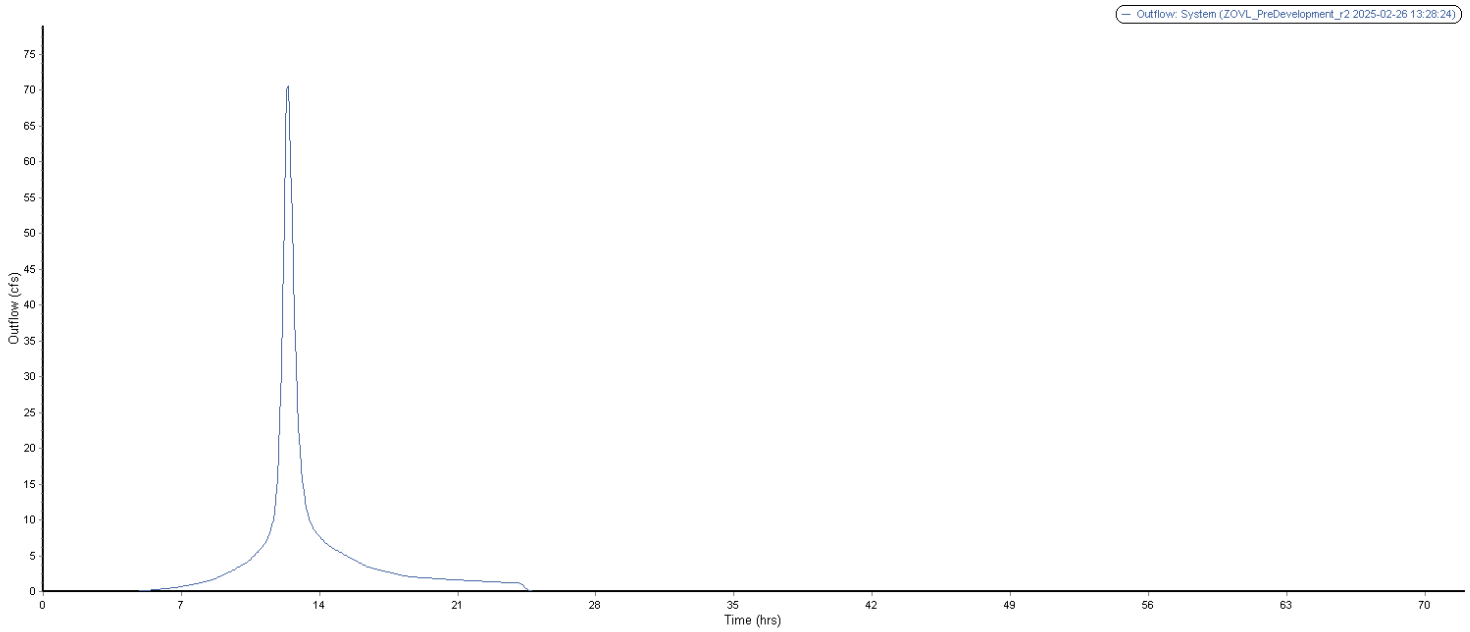
Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	21.00	170.00	232.00
Slope (%):	14.50	5.00	5.00
Surface Type:	Woodland	Unpaved	Woodland
Velocity (ft/sec):	1.90	3.61	1.12
Computed Flow Time (minutes):	0.18	0.78	3.45
Total TOC (minutes):	25.51		

****
Subbasin Runoff Summary
****

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days	hh:mm:ss
Catch-E1	9.40	7.38	27.16	83.480	0	00:31:30
Catch-E2	9.40	7.26	44.43	82.510	0	00:25:30

Analysis began on: Wed Feb 26 13:28:14 2025
Analysis ended on: Wed Feb 26 13:28:23 2025
Total elapsed time: 00:00:09


Outflow: System (ZOVL_PreDevelopment_r2 2025-02-26 13:28:24)
Outflow (cfs)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
0
7
14
21
28
35
42
49
56
63
70
Time (hrs)

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.0.94 (Build 0)

****
Project Description
****
File Name ..... ZOVL_PostDevelopment_r1.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. SCS TR-20
Time of Concentration..... SCS TR-55
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. Constant rate, projected area
Starting Date MAY-06-2024 00:00:00
Ending Date MAY-09-2024 00:00:00
Report Time Step 00:04:00

****
Element Count
****
Number of rain gages 1
Number of subbasins 4
Number of nodes 10
Number of links 12

****
Raingage Summary
****

Gage ID	Data Source	Data Type	Recording Interval min
Rain Gage-01	2YR 24HR (Future)	CUMULATIVE	1.00

****
Subbasin Summary
****

Subbasin ID	Total Area ft²
Catch-P1	86824.66
Catch-P2	115184.55
Catch-P3	234457.05
Catch-P4	189338.22

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
Jun-02-Out2	JUNCTION	916.00	920.33	0.00	
Jun-03-Out2	JUNCTION	916.00	999.00	1000.00	
Jun-04-Out2	JUNCTION	916.00	921.50	0.00	
Jun-05-Out1	JUNCTION	935.00	999.00	1000.00	
Jun-06-Out1	JUNCTION	935.00	937.75	0.00	
Jun-07-Out1	JUNCTION	935.00	939.00	0.00	

DP-1	OUTFALL	0.00	936.00	0.00
DP-2	OUTFALL	0.00	917.50	0.00
Stor-02-POND2	STORAGE	916.00	921.00	10000.00
Stor-04-POND1	STORAGE	935.00	939.00	10000.00

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
Link-01-RipRap-2	Jun-03-Out2	Jun-04-Out2	CHANNEL	15.0	33.3333	0.0330
Link-02-Surface-2	Jun-04-Out2	DP-2	CHANNEL	10.0	5.0000	0.0200
Link-03-RipRap1	Jun-05-Out1	Jun-07-Out1	CHANNEL	12.0	25.0000	0.0330
Link-04-Surface1	Jun-07-Out1	DP-1	CHANNEL	30.0	3.3333	0.0200
Orifice-01-2yr-2	Stor-02-POND2	Jun-02-Out2	ORIFICE			
Orifice-02-10yr-2	Stor-02-POND2	Jun-02-Out2	ORIFICE			
Orifice-03-OutletPipe2	Jun-02-Out2	Jun-04-Out2	ORIFICE			
Orifice-04-2yr-1	Stor-04-POND1	Jun-06-Out1	ORIFICE			
Orifice-05-10yr-1	Stor-04-POND1	Jun-06-Out1	ORIFICE			
Orifice-06-OutletPipe1	Jun-06-Out1	Jun-07-Out1	ORIFICE			
Weir-02-100yr-2	Stor-02-POND2	Jun-03-Out2	WEIR			
Weir-04-100yr-1	Stor-04-POND1	Jun-05-Out1	WEIR			

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
Link-01-RipRap-2	TRAPEZOIDAL	0.50	10.00	1	4.25	0.42	61.79
Link-02-Surface-2	RECT_OPEN	2.00	10.00	1	20.00	1.43	421.47
Link-03-RipRap1	TRAPEZOIDAL	0.50	10.00	1	4.25	0.42	53.51
Link-04-Surface1	RECT_OPEN	2.00	10.00	1	20.00	1.43	344.13

********** Runoff Quantity Continuity	Volume acre-ft	Depth inches
Total Precipitation	4.612	3.852
Surface Runoff	0.012	0.010
Continuity Error (%)	-0.001	

********** Flow Routing Continuity	Volume acre-ft	Volume Mgallons
External Inflow	0.000	0.000
External Outflow	2.883	0.940
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

****
Composite Curve Number Computations Report
****

Subbasin Catch-P1

Soil/Surface Description	Area (ft²)	Soil Group	CN
Woods, Fair	28528.90	D	79.00
Woods & grass combination, Fair	58295.76	D	82.00
Composite Area & Weighted CN	86824.66		81.01

Subbasin Catch-P2

Soil/Surface Description	Area (ft²)	Soil Group	CN
Paved parking & roofs	27947.90	D	98.00
Meadow, non-grazed	33451.85	D	78.00
Gravel roads	53784.80	D	91.00
Composite Area & Weighted CN	115184.55		88.92

Subbasin Catch-P3

Soil/Surface Description	Area (ft²)	Soil Group	CN
Woods, Fair	121539.49	D	79.00
Meadow, non-grazed	112917.56	D	78.00
Composite Area & Weighted CN	234457.05		78.52

Subbasin Catch-P4

Soil/Surface Description	Area (ft²)	Soil Group	CN
Paved parking & roofs	83026.68	D	98.00
Meadow, non-grazed	20512.93	D	78.00
Gravel roads	85798.65	D	91.00
Composite Area & Weighted CN	189338.26		92.66

****
SCS TR-55 Time of Concentration Computations Report
****

Sheet Flow Equation

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where:

Tc = Time of Concentration (hrs)
n = Manning's Roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation

V = 16.1345 * (Sf^0.5) (unpaved surface)

V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's Roughness

Subbasin Catch-P1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	100.00	0.00	0.00
Slope (%):	7.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	3.00	3.00	3.00
Velocity (ft/sec):	0.12	0.00	0.00
Computed Flow Time (minutes):	13.44	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	305.00	0.00	0.00
Slope (%):	10.80	0.00	0.00
Surface Type:	Woodland	Woodland	Woodland
Velocity (ft/sec):	1.64	0.00	0.00
Computed Flow Time (minutes):	3.10	0.00	0.00

Total TOC (minutes):	16.54

Subbasin Catch-P2

User-Defined TOC override (minutes): 6.00

Subbasin Catch-P3

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	100.00	0.00	0.00
Slope (%):	4.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	3.00	3.00	3.00
Velocity (ft/sec):	0.10	0.00	0.00
Computed Flow Time (minutes):	16.81	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	342.00	178.00	270.00
Slope (%):	7.50	7.00	5.00
Surface Type:	Grass pasture	Woodland	Woodland
Velocity (ft/sec):	1.92	1.32	1.12
Computed Flow Time (minutes):	2.97	2.25	4.02

Channel Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.02	0.00	0.00
Flow Length (ft):	974.00	0.00	0.00
Channel Slope (%):	1.70	0.00	0.00
Cross Section Area (ft²):	5.00	0.00	0.00
Wetted Perimeter (ft):	6.33	0.00	0.00
Velocity (ft/sec):	8.30	0.00	0.00
Computed Flow Time (minutes):	1.96	0.00	0.00
Total TOC (minutes):	28.00		

Subbasin Catch-P4

User-Defined TOC override (minutes): 6.00

****
Subbasin Runoff Summary
****

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days	Time of Concentration hh:mm:ss
Catch-P1	3.90	2.04	3.51	81.010	0	00:16:32
Catch-P2	3.90	2.72	8.14	88.920	0	00:06:00
Catch-P3	3.90	1.85	6.91	78.520	0	00:28:00
Catch-P4	3.90	3.09	14.77	92.660	0	00:06:00

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Flooded Time minutes	Retention Time hh:mm:ss

Jun-02-Out2	0.04	0.59	916.59	0	12:23	0	0	0:00:00
Jun-03-Out2	0.00	0.00	916.00	0	00:00	0	0	0:00:00
Jun-04-Out2	0.01	0.13	916.13	0	12:29	0	0	0:00:00
Jun-05-Out1	0.00	0.00	935.00	0	00:00	0	0	0:00:00
Jun-06-Out1	0.03	0.39	935.39	0	12:34	0	0	0:00:00
Jun-07-Out1	0.01	0.08	935.08	0	12:34	0	0	0:00:00
DP-1	0.00	0.00	0.00	0	00:00	0	0	0:00:00
DP-2	0.00	0.00	0.00	0	00:00	0	0	0:00:00
Stor-02-POND2	0.12	2.98	918.98	0	12:29	0	0	0:00:00
Stor-04-POND1	0.08	1.39	936.39	0	12:34	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	hh:mm
Jun-02-Out2	JUNCTION	0.00	4.12	0	12:29	0.00		
Jun-03-Out2	JUNCTION	0.00	0.00	0	00:00	0.00		
Jun-04-Out2	JUNCTION	0.00	4.14	0	12:35	0.00		
Jun-05-Out1	JUNCTION	0.00	0.00	0	00:00	0.00		
Jun-06-Out1	JUNCTION	0.00	1.74	0	12:34	0.00		
Jun-07-Out1	JUNCTION	0.00	1.74	0	12:34	0.00		
DP-1	OUTFALL	3.50	5.10	0	12:16	0.00		
DP-2	OUTFALL	6.90	10.99	0	12:24	0.00		
Stor-02-POND2	STORAGE	14.65	14.65	0	12:08	0.00		
Stor-04-POND1	STORAGE	8.07	8.07	0	12:08	0.00		

****
Storage Node Summary
****

Storage Node ID	Maximum Ponded Volume 1000 ft³	Maximum Ponded Volume (%)	Time of Max Ponded Volume days	hh:mm	Average Ponded Volume 1000 ft³	Average Ponded Volume (%)	Maximum Storage Node Outflow cfs	Maximum Exfiltration Rate cfm	Time of Max. Exfiltration Rate hh:mm:ss	Total Exfiltrated Volume 1000 ft³
Stor-02-POND2	13.886	49	0	12:29	0.480	2	4.12	0.00	0:00:00	0.000
Stor-04-POND1	9.852	27	0	12:34	0.552	2	1.74	0.00	0:00:00	0.000

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs

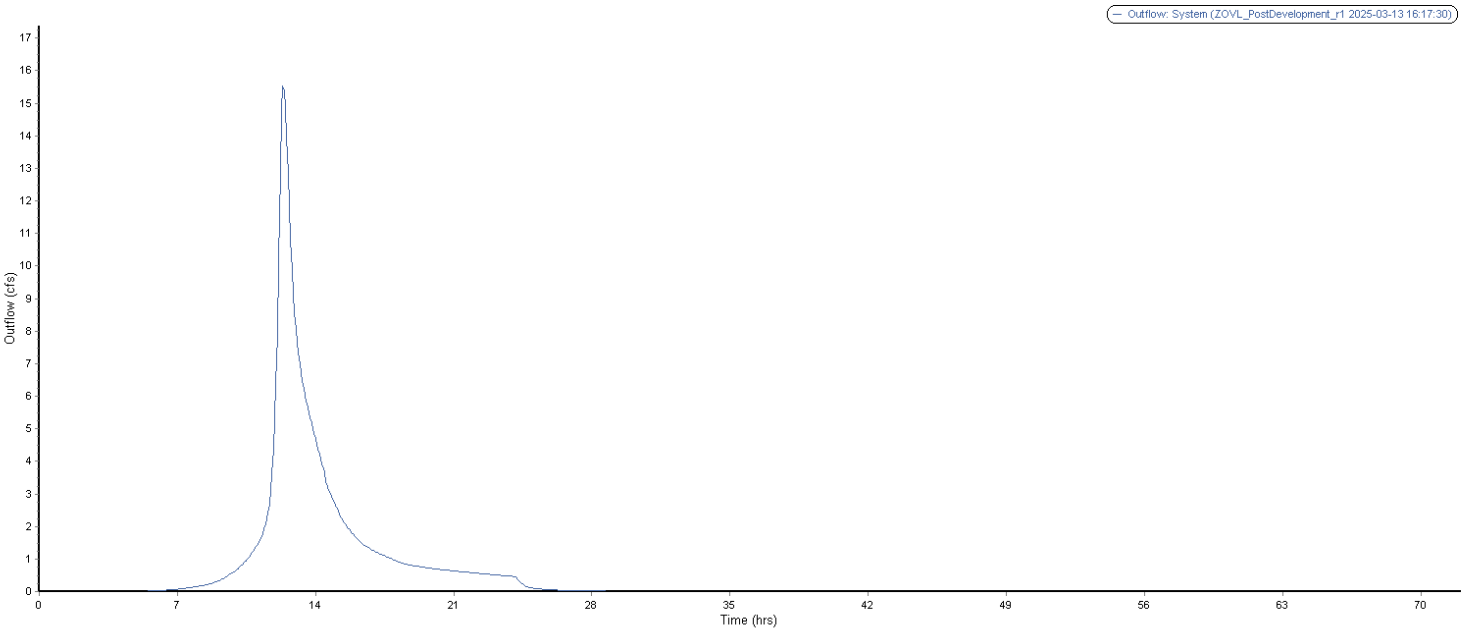
DP-1	46.14	0.34	5.10
DP-2	38.24	0.85	10.99
System	42.19	1.20	15.52

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Total Reported Condition	Maximum Flow Depth	Time Surcharged minutes
Link-01-RipRap-2	CHANNEL	0 00:00	0.00	1.00	0.00	61.79	0.00	0.13	0	Calculated
Link-02-Surface-2	CHANNEL	0 12:29	3.49	1.00	4.12	421.47	0.01	0.06	0	Calculated
Link-03-RipRap1	CHANNEL	0 00:00	0.00	1.00	0.00	53.51	0.00	0.08	0	Calculated
Link-04-Surface1	CHANNEL	0 12:34	2.33	1.00	1.74	344.13	0.01	0.04	0	Calculated
Orifice-01-2yr-2	ORIFICE	0 12:29			4.12					
Orifice-02-10yr-2	ORIFICE	0 00:00			0.00					
Orifice-03-OutletPipe2	ORIFICE	0 12:35			4.14					
Orifice-04-2yr-1	ORIFICE	0 12:34			1.74					
Orifice-05-10yr-1	ORIFICE	0 00:00			0.00					
Orifice-06-OutletPipe1	ORIFICE	0 12:34			1.74					
Weir-02-100yr-2	WEIR	0 00:00			0.00			0.00		
Weir-04-100yr-1	WEIR	0 00:00			0.00			0.00		

****
Highest Flow Instability Indexes
****
All links are stable.

Analysis began on: Thu Mar 13 16:17:16 2025
Analysis ended on: Thu Mar 13 16:17:29 2025
Total elapsed time: 00:00:13


Outflow: System (ZOVL_PostDevelopment_r1 2025-03-13 16:17:30)
Outflow (cfs)
Time (hrs)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
0
7
14
21
28
35
42
49
56
63
70

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.0.94 (Build 0)

****
Project Description
****
File Name ..... ZOVL_PostDevelopment_r1.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. SCS TR-20
Time of Concentration..... SCS TR-55
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. Constant rate, projected area
Starting Date MAY-06-2024 00:00:00
Ending Date MAY-09-2024 00:00:00
Report Time Step 00:04:00

****
Element Count
****
Number of rain gages 1
Number of subbasins 4
Number of nodes 10
Number of links 12

****
Raingage Summary
****

Gage ID	Data Source	Data Type	Recording Interval min
Rain Gage-01	10YR 24HR (Future)	CUMULATIVE	1.00

****
Subbasin Summary
****

Subbasin ID	Total Area ft²
Catch-P1	86824.66
Catch-P2	115184.55
Catch-P3	234457.05
Catch-P4	189338.22

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
Jun-02-Out2	JUNCTION	916.00	920.33	0.00	
Jun-03-Out2	JUNCTION	916.00	999.00	1000.00	
Jun-04-Out2	JUNCTION	916.00	921.50	0.00	
Jun-05-Out1	JUNCTION	935.00	999.00	1000.00	
Jun-06-Out1	JUNCTION	935.00	937.75	0.00	
Jun-07-Out1	JUNCTION	935.00	939.00	0.00	

DP-1	OUTFALL	0.00	936.00	0.00
DP-2	OUTFALL	0.00	917.50	0.00
Stor-02-POND2	STORAGE	916.00	921.00	10000.00
Stor-04-POND1	STORAGE	935.00	939.00	10000.00

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
Link-01-RipRap-2	Jun-03-Out2	Jun-04-Out2	CHANNEL	15.0	33.3333	0.0330
Link-02-Surface-2	Jun-04-Out2	DP-2	CHANNEL	10.0	5.0000	0.0200
Link-03-RipRap1	Jun-05-Out1	Jun-07-Out1	CHANNEL	12.0	25.0000	0.0330
Link-04-Surface1	Jun-07-Out1	DP-1	CHANNEL	30.0	3.3333	0.0200
Orifice-01-2yr-2	Stor-02-POND2	Jun-02-Out2	ORIFICE			
Orifice-02-10yr-2	Stor-02-POND2	Jun-02-Out2	ORIFICE			
Orifice-03-OutletPipe2	Jun-02-Out2	Jun-04-Out2	ORIFICE			
Orifice-04-2yr-1	Stor-04-POND1	Jun-06-Out1	ORIFICE			
Orifice-05-10yr-1	Stor-04-POND1	Jun-06-Out1	ORIFICE			
Orifice-06-OutletPipe1	Jun-06-Out1	Jun-07-Out1	ORIFICE			
Weir-02-100yr-2	Stor-02-POND2	Jun-03-Out2	WEIR			
Weir-04-100yr-1	Stor-04-POND1	Jun-05-Out1	WEIR			

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
Link-01-RipRap-2	TRAPEZOIDAL	0.50	10.00	1	4.25	0.42	61.79
Link-02-Surface-2	RECT_OPEN	2.00	10.00	1	20.00	1.43	421.47
Link-03-RipRap1	TRAPEZOIDAL	0.50	10.00	1	4.25	0.42	53.51
Link-04-Surface1	RECT_OPEN	2.00	10.00	1	20.00	1.43	344.13

********** Runoff Quantity Continuity	Volume acre-ft	Depth inches
Total Precipitation	7.096	5.927
Surface Runoff	0.022	0.018
Continuity Error (%)	-0.001	

********** Flow Routing Continuity	Volume acre-ft	Volume Mgallons
External Inflow	0.000	0.000
External Outflow	5.176	1.687
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

****
Composite Curve Number Computations Report
****

Subbasin Catch-P1

Soil/Surface Description	Area (ft²)	Soil Group	CN
Woods, Fair	28528.90	D	79.00
Woods & grass combination, Fair	58295.76	D	82.00
Composite Area & Weighted CN	86824.66		81.01

Subbasin Catch-P2

Soil/Surface Description	Area (ft²)	Soil Group	CN
Paved parking & roofs	27947.90	D	98.00
Meadow, non-grazed	33451.85	D	78.00
Gravel roads	53784.80	D	91.00
Composite Area & Weighted CN	115184.55		88.92

Subbasin Catch-P3

Soil/Surface Description	Area (ft²)	Soil Group	CN
Woods, Fair	121539.49	D	79.00
Meadow, non-grazed	112917.56	D	78.00
Composite Area & Weighted CN	234457.05		78.52

Subbasin Catch-P4

Soil/Surface Description	Area (ft²)	Soil Group	CN
Paved parking & roofs	83026.68	D	98.00
Meadow, non-grazed	20512.93	D	78.00
Gravel roads	85798.65	D	91.00
Composite Area & Weighted CN	189338.26		92.66

****
SCS TR-55 Time of Concentration Computations Report
****

Sheet Flow Equation

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where:

Tc = Time of Concentration (hrs)
n = Manning's Roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation

V = 16.1345 * (Sf^0.5) (unpaved surface)

V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's Roughness

Subbasin Catch-P1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	100.00	0.00	0.00
Slope (%):	7.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	3.00	3.00	3.00
Velocity (ft/sec):	0.12	0.00	0.00
Computed Flow Time (minutes):	13.44	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	305.00	0.00	0.00
Slope (%):	10.80	0.00	0.00
Surface Type:	Woodland	Woodland	Woodland
Velocity (ft/sec):	1.64	0.00	0.00
Computed Flow Time (minutes):	3.10	0.00	0.00

Total TOC (minutes): 16.54

Subbasin Catch-P2

User-Defined TOC override (minutes): 6.00

Subbasin Catch-P3

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	100.00	0.00	0.00
Slope (%):	4.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	3.00	3.00	3.00
Velocity (ft/sec):	0.10	0.00	0.00
Computed Flow Time (minutes):	16.81	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	342.00	178.00	270.00
Slope (%):	7.50	7.00	5.00
Surface Type:	Grass pasture	Woodland	Woodland
Velocity (ft/sec):	1.92	1.32	1.12
Computed Flow Time (minutes):	2.97	2.25	4.02

Channel Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.02	0.00	0.00
Flow Length (ft):	974.00	0.00	0.00
Channel Slope (%):	1.70	0.00	0.00
Cross Section Area (ft²):	5.00	0.00	0.00
Wetted Perimeter (ft):	6.33	0.00	0.00
Velocity (ft/sec):	8.30	0.00	0.00
Computed Flow Time (minutes):	1.96	0.00	0.00
Total TOC (minutes):	28.00		

Subbasin Catch-P4

User-Defined TOC override (minutes): 6.00

****
Subbasin Runoff Summary
****

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days	Time of Concentration hh:mm:ss
Catch-P1	6.00	3.88	6.67	81.010	0	00:16:32
Catch-P2	6.00	4.73	13.77	88.920	0	00:06:00
Catch-P3	6.00	3.63	13.66	78.520	0	00:28:00
Catch-P4	6.00	5.14	23.88	92.660	0	00:06:00

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Flooded Time minutes	Retention Time hh:mm:ss

Jun-02-Out2	0.07	2.84	918.84	0	12:21	0	0	0:00:00
Jun-03-Out2	0.06	0.07	916.07	0	12:23	0	0	0:00:00
Jun-04-Out2	0.01	0.24	916.24	0	12:21	0	0	0:00:00
Jun-05-Out1	0.00	0.00	935.00	0	00:00	0	0	0:00:00
Jun-06-Out1	0.05	0.74	935.74	0	12:33	0	0	0:00:00
Jun-07-Out1	0.01	0.11	935.11	0	12:33	0	0	0:00:00
DP-1	0.00	0.00	0.00	0	00:00	0	0	0:00:00
DP-2	0.00	0.00	0.00	0	00:00	0	0	0:00:00
Stor-02-POND2	0.18	4.01	920.01	0	12:21	0	0	0:00:00
Stor-04-POND1	0.14	2.25	937.25	0	12:32	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	hh:mm
Jun-02-Out2	JUNCTION	0.00	9.75	0	12:21	0.00		
Jun-03-Out2	JUNCTION	0.00	0.01	0	12:21	0.00		
Jun-04-Out2	JUNCTION	0.00	9.75	0	12:21	0.00		
Jun-05-Out1	JUNCTION	0.00	0.00	0	00:00	0.00		
Jun-06-Out1	JUNCTION	0.00	3.08	0	12:32	0.00		
Jun-07-Out1	JUNCTION	0.00	3.08	0	12:33	0.00		
DP-1	OUTFALL	6.65	8.81	0	12:16	0.00		
DP-2	OUTFALL	13.65	23.37	0	12:23	0.00		
Stor-02-POND2	STORAGE	23.77	23.77	0	12:08	0.00		
Stor-04-POND1	STORAGE	13.68	13.68	0	12:08	0.00		

****
Storage Node Summary
****

Storage Node ID	Maximum Ponded Volume 1000 ft³	Maximum Ponded Volume (%)	Time of Max Ponded Volume days	hh:mm	Average Ponded Volume 1000 ft³	Average Ponded Volume (%)	Maximum Storage Node Outflow cfs	Maximum Exfiltration Rate cfm	Time of Max. Exfiltration Rate hh:mm:ss	Total Exfiltrated Volume 1000 ft³
Stor-02-POND2	20.577	73	0	12:21	0.728	3	9.76	0.00	0:00:00	0.000
Stor-04-POND1	17.325	48	0	12:32	1.001	3	3.08	0.00	0:00:00	0.000

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs

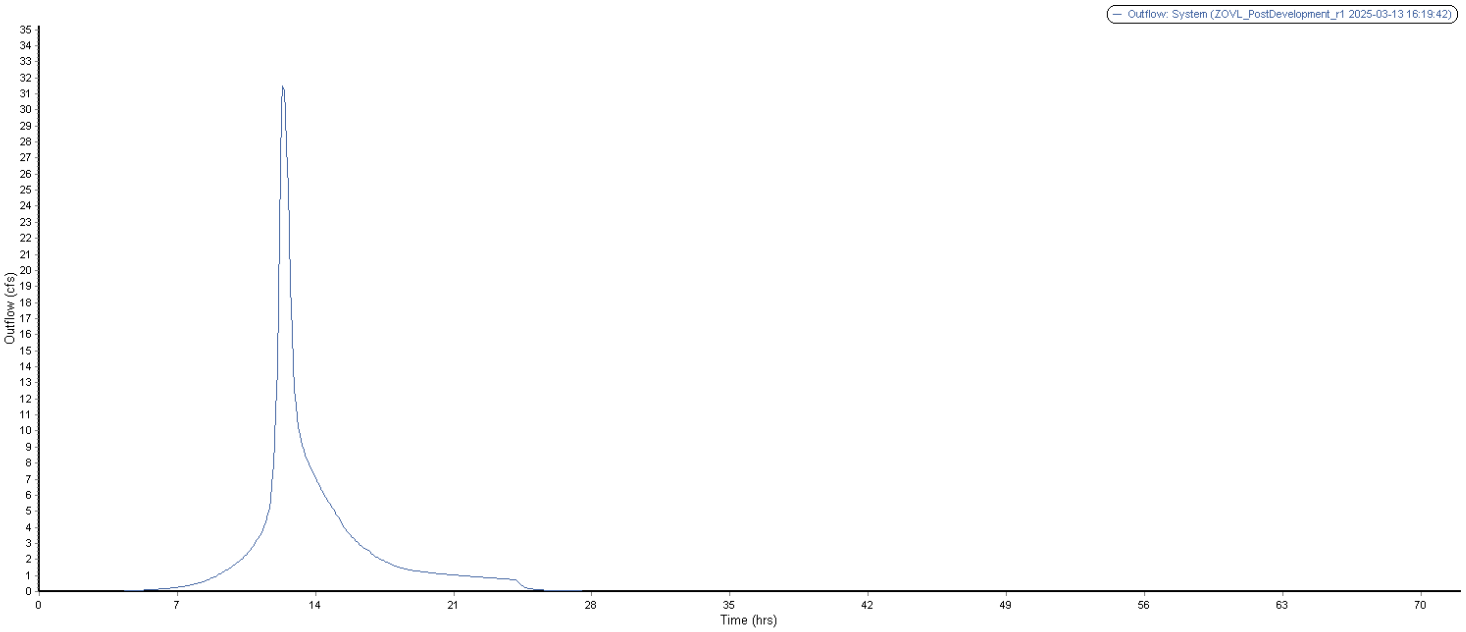
DP-1	49.49	0.57	8.81
DP-2	40.46	1.45	23.37
System	44.97	2.02	31.46

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Total Reported Condition	Maximum Surcharged Depth	Time minutes
Link-01-RipRap-2	CHANNEL	0 00:00	0.00	1.00	0.00	61.79	0.00	0.24	0	Calculated
Link-02-Surface-2	CHANNEL	0 12:21	4.62	1.00	9.75	421.47	0.02	0.11	0	Calculated
Link-03-RipRap1	CHANNEL	0 00:00	0.00	1.00	0.00	53.51	0.00	0.11	0	Calculated
Link-04-Surface1	CHANNEL	0 12:33	2.89	1.00	3.08	344.13	0.01	0.05	0	Calculated
Orifice-01-2yr-2	ORIFICE	0 12:07			4.15					
Orifice-02-10yr-2	ORIFICE	0 12:21			6.87					
Orifice-03-OutletPipe2	ORIFICE	0 12:21			9.75					
Orifice-04-2yr-1	ORIFICE	0 12:18			2.21					
Orifice-05-10yr-1	ORIFICE	0 12:32			0.95					
Orifice-06-OutletPipe1	ORIFICE	0 12:33			3.08					
Weir-02-100yr-2	WEIR	0 12:21			0.01			0.01		
Weir-04-100yr-1	WEIR	0 00:00			0.00			0.00		

****
Highest Flow Instability Indexes
****
All links are stable.

Analysis began on: Thu Mar 13 16:19:27 2025
Analysis ended on: Thu Mar 13 16:19:41 2025
Total elapsed time: 00:00:14


Outflow: System (ZOVL_PostDevelopment_r1 2025-03-13 16:19:42)
Outflow (cfs)
Time (hrs)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
0
7
14
21
28
35
42
49
56
63
70

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.0.94 (Build 0)

****
Project Description
****
File Name ..... ZOVL_PostDevelopment_r1.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. SCS TR-20
Time of Concentration..... SCS TR-55
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. Constant rate, projected area
Starting Date MAY-06-2024 00:00:00
Ending Date MAY-09-2024 00:00:00
Report Time Step 00:04:00

****
Element Count
****
Number of rain gages 1
Number of subbasins 4
Number of nodes 10
Number of links 12

****
Raingage Summary
****

Gage ID	Data Source	Data Type	Recording Interval min
Rain Gage-01	100YR 24HR (Future)	CUMULATIVE	1.00

****
Subbasin Summary
****

Subbasin ID	Total Area ft²
Catch-P1	86824.66
Catch-P2	115184.55
Catch-P3	234457.05
Catch-P4	189338.22

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
Jun-02-Out2	JUNCTION	916.00	920.33	0.00	
Jun-03-Out2	JUNCTION	916.00	999.00	1000.00	
Jun-04-Out2	JUNCTION	916.00	921.50	0.00	
Jun-05-Out1	JUNCTION	935.00	999.00	1000.00	
Jun-06-Out1	JUNCTION	935.00	937.75	0.00	
Jun-07-Out1	JUNCTION	935.00	939.00	0.00	

DP-1	OUTFALL	0.00	936.00	0.00
DP-2	OUTFALL	0.00	917.50	0.00
Stor-02-POND2	STORAGE	916.00	921.00	10000.00
Stor-04-POND1	STORAGE	935.00	939.00	10000.00

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
Link-01-RipRap-2	Jun-03-Out2	Jun-04-Out2	CHANNEL	15.0	33.3333	0.0330
Link-02-Surface-2	Jun-04-Out2	DP-2	CHANNEL	10.0	5.0000	0.0200
Link-03-RipRap1	Jun-05-Out1	Jun-07-Out1	CHANNEL	12.0	25.0000	0.0330
Link-04-Surface1	Jun-07-Out1	DP-1	CHANNEL	30.0	3.3333	0.0200
Orifice-01-2yr-2	Stor-02-POND2	Jun-02-Out2	ORIFICE			
Orifice-02-10yr-2	Stor-02-POND2	Jun-02-Out2	ORIFICE			
Orifice-03-OutletPipe2	Jun-02-Out2	Jun-04-Out2	ORIFICE			
Orifice-04-2yr-1	Stor-04-POND1	Jun-06-Out1	ORIFICE			
Orifice-05-10yr-1	Stor-04-POND1	Jun-06-Out1	ORIFICE			
Orifice-06-OutletPipe1	Jun-06-Out1	Jun-07-Out1	ORIFICE			
Weir-02-100yr-2	Stor-02-POND2	Jun-03-Out2	WEIR			
Weir-04-100yr-1	Stor-04-POND1	Jun-05-Out1	WEIR			

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
Link-01-RipRap-2	TRAPEZOIDAL	0.50	10.00	1	4.25	0.42	61.79
Link-02-Surface-2	RECT_OPEN	2.00	10.00	1	20.00	1.43	421.47
Link-03-RipRap1	TRAPEZOIDAL	0.50	10.00	1	4.25	0.42	53.51
Link-04-Surface1	RECT_OPEN	2.00	10.00	1	20.00	1.43	344.13

********** Runoff Quantity Continuity	Volume acre-ft	Depth inches
Total Precipitation	11.117	9.286
Surface Runoff	0.038	0.032
Continuity Error (%)	-0.001	

********** Flow Routing Continuity	Volume acre-ft	Volume Mgallons
External Inflow	0.000	0.000
External Outflow	9.060	2.952
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

****
Composite Curve Number Computations Report
****

Subbasin Catch-P1

Soil/Surface Description	Area (ft²)	Soil Group	CN
Woods, Fair	28528.90	D	79.00
Woods & grass combination, Fair	58295.76	D	82.00
Composite Area & Weighted CN	86824.66		81.01

Subbasin Catch-P2

Soil/Surface Description	Area (ft²)	Soil Group	CN
Paved parking & roofs	27947.90	D	98.00
Meadow, non-grazed	33451.85	D	78.00
Gravel roads	53784.80	D	91.00
Composite Area & Weighted CN	115184.55		88.92

Subbasin Catch-P3

Soil/Surface Description	Area (ft²)	Soil Group	CN
Woods, Fair	121539.49	D	79.00
Meadow, non-grazed	112917.56	D	78.00
Composite Area & Weighted CN	234457.05		78.52

Subbasin Catch-P4

Soil/Surface Description	Area (ft²)	Soil Group	CN
Paved parking & roofs	83026.68	D	98.00
Meadow, non-grazed	20512.93	D	78.00
Gravel roads	85798.65	D	91.00
Composite Area & Weighted CN	189338.26		92.66

****
SCS TR-55 Time of Concentration Computations Report
****

Sheet Flow Equation

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where:

Tc = Time of Concentration (hrs)
n = Manning's Roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation

V = 16.1345 * (Sf^0.5) (unpaved surface)

V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's Roughness

Subbasin Catch-P1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	100.00	0.00	0.00
Slope (%):	7.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	3.00	3.00	3.00
Velocity (ft/sec):	0.12	0.00	0.00
Computed Flow Time (minutes):	13.44	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	305.00	0.00	0.00
Slope (%):	10.80	0.00	0.00
Surface Type:	Woodland	Woodland	Woodland
Velocity (ft/sec):	1.64	0.00	0.00
Computed Flow Time (minutes):	3.10	0.00	0.00

Total TOC (minutes):	16.54

Subbasin Catch-P2

User-Defined TOC override (minutes): 6.00

Subbasin Catch-P3

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	100.00	0.00	0.00
Slope (%):	4.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	3.00	3.00	3.00
Velocity (ft/sec):	0.10	0.00	0.00
Computed Flow Time (minutes):	16.81	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	342.00	178.00	270.00
Slope (%):	7.50	7.00	5.00
Surface Type:	Grass pasture	Woodland	Woodland
Velocity (ft/sec):	1.92	1.32	1.12
Computed Flow Time (minutes):	2.97	2.25	4.02

Channel Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.02	0.00	0.00
Flow Length (ft):	974.00	0.00	0.00
Channel Slope (%):	1.70	0.00	0.00
Cross Section Area (ft²):	5.00	0.00	0.00
Wetted Perimeter (ft):	6.33	0.00	0.00
Velocity (ft/sec):	8.30	0.00	0.00
Computed Flow Time (minutes):	1.96	0.00	0.00
Total TOC (minutes):	28.00		

Subbasin Catch-P4

User-Defined TOC override (minutes): 6.00

****
Subbasin Runoff Summary
****

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days	Time of Concentration hh:mm:ss
Catch-P1	9.40	7.07	11.90	81.010	0	00:16:32
Catch-P2	9.40	8.05	22.76	88.920	0	00:06:00
Catch-P3	9.40	6.76	25.10	78.520	0	00:28:00
Catch-P4	9.40	8.51	38.43	92.660	0	00:06:00

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Flooded Time minutes	Retention Time hh:mm:ss

Jun-02-Out2	0.12	3.97	919.97	0	12:17	0	0	0:00:00
Jun-03-Out2	3.34	5.14	921.14	0	12:17	0	0	0:00:00
Jun-04-Out2	0.02	0.39	916.39	0	12:17	0	0	0:00:00
Jun-05-Out1	2.49	3.07	938.07	0	12:28	0	0	0:00:00
Jun-06-Out1	0.09	1.65	936.65	0	12:28	0	0	0:00:00
Jun-07-Out1	0.01	0.18	935.18	0	12:28	0	0	0:00:00
DP-1	0.00	0.00	0.00	0	00:00	0	0	0:00:00
DP-2	0.00	0.00	0.00	0	00:00	0	0	0:00:00
Stor-02-POND2	0.26	5.42	921.42	0	12:17	1.15	26	0:00:00
Stor-04-POND1	0.22	3.28	938.28	0	12:28	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	hh:mm
Jun-02-Out2	JUNCTION	0.00	11.44	0	12:17	0.00		
Jun-03-Out2	JUNCTION	0.00	7.37	0	12:17	0.00		
Jun-04-Out2	JUNCTION	0.00	18.81	0	12:17	0.00		
Jun-05-Out1	JUNCTION	0.00	1.90	0	12:28	0.00		
Jun-06-Out1	JUNCTION	0.00	4.69	0	12:28	0.00		
Jun-07-Out1	JUNCTION	0.00	6.59	0	12:28	0.00		
DP-1	OUTFALL	11.84	16.35	0	12:17	0.00		
DP-2	OUTFALL	24.99	43.24	0	12:20	0.00		
Stor-02-POND2	STORAGE	38.22	38.22	0	12:08	23.41	0	12:10
Stor-04-POND1	STORAGE	22.65	22.65	0	12:08	0.00		

****
Storage Node Summary
****

Storage Node ID	Maximum Ponded Volume 1000 ft³	Maximum Ponded Volume (%)	Time of Max Ponded Volume days	hh:mm	Average Ponded Volume 1000 ft³	Average Ponded Volume (%)	Maximum Storage Node Outflow cfs	Maximum Time of Max. Total Exfiltration Rate cfm	hh:mm:ss	Total Exfiltrated Volume 1000 ft³
Stor-02-POND2	28.081	100	0	12:10	1.147	4	18.81	0.00	0:00:00	0.000
Stor-04-POND1	27.827	77	0	12:28	1.596	4	6.59	0.00	0:00:00	0.000

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs

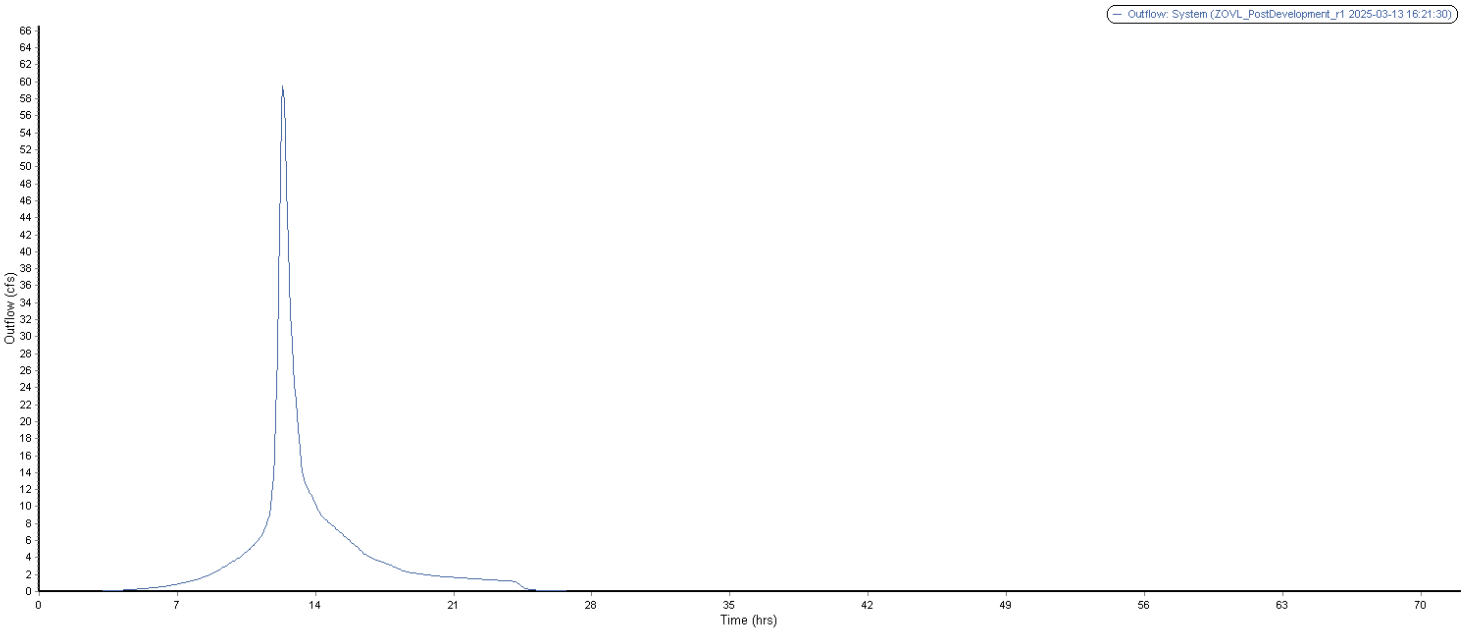
DP-1	52.29	0.95	16.35
DP-2	42.23	2.43	43.24
System	47.26	3.38	59.45

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence	Maximum Velocity Attained	Length Factor	Peak Flow during Analysis	Design Flow Capacity	Ratio of Maximum /Design Flow	Ratio of Maximum Depth	Total Time Surcharged
		days hh:mm	ft/sec		cfs	cfs			minutes
Link-01-RipRap-2	CHANNEL	0 12:17	3.51	1.00	7.37	61.79	0.12	0.54	0 Calculated
Link-02-Surface-2	CHANNEL	0 12:17	5.62	1.00	18.81	421.47	0.04	0.17	0 Calculated
Link-03-RipRap1	CHANNEL	0 12:28	2.07	1.00	1.90	53.51	0.04	0.25	0 Calculated
Link-04-Surface1	CHANNEL	0 12:28	3.83	1.00	6.59	344.13	0.02	0.09	0 Calculated
Orifice-01-2yr-2	ORIFICE	0 11:57			4.15				
Orifice-02-10yr-2	ORIFICE	0 12:17			8.23				
Orifice-03-OutletPipe2	ORIFICE	0 12:17			11.44				
Orifice-04-2yr-1	ORIFICE	0 12:27			2.22				
Orifice-05-10yr-1	ORIFICE	0 12:28			2.47				
Orifice-06-OutletPipe1	ORIFICE	0 12:28			4.69				
Weir-02-100yr-2	WEIR	0 12:17			7.37			1.00	
Weir-04-100yr-1	WEIR	0 12:28			1.90			0.28	

****
Highest Flow Instability Indexes
****
All links are stable.

Analysis began on: Thu Mar 13 16:21:14 2025
Analysis ended on: Thu Mar 13 16:21:29 2025
Total elapsed time: 00:00:15


Outflow: System (ZOVL_PostDevelopment_r1 2025-03-13 16:21:30)
Outflow (cfs)
Time (hrs)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
52
54
56
58
60
62
64
66
0
7
14
21
28
35
42
49
56
63
70

Appendix J: Operations and Maintenance Plan

Moraga Storage LLC - ZOVL
Stormwater Management Systems
Operations and Maintenance Plan

RESPONSIBLE PARTY DURING CONSTRUCTION: TBD

RESPONSIBLE PARTY POST CONSTRUCTION: TBD

Construction Phase

During the construction phase, all erosion control devices and measures shall be maintained in accordance with the final record plans, local/state approvals and conditions, and the EPA General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities, if applicable. Additionally, the maintenance of all erosion / siltation control measures during construction shall be the responsibility of the general contractor. Upon proper notice to the property owner, the Town/City or its authorized designee shall be allowed to enter the property at a reasonable time and in a reasonable manner for the purposes of inspection. Due to the complex nature of the project, a more detailed description of the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan before any land disturbance begins.

Long-term Pollution Prevention Plan

Standard 4 requires the development of suitable practices for source control and pollution prevention. These measures must be identified in a long-term pollution prevention plan in a subsequent design phase. The long-term pollution prevention plan shall include the proper procedures for the following:

- good housekeeping;
- storing materials and water products inside or under cover;
- vehicle washing;
- routine inspections and maintenance of stormwater BMPs;
- spill prevention and response;
- maintenance of lawns, gardens, and other landscapes areas;
- storage and use of fertilizers, herbicides, and pesticides;
- pet waste management;
- operation and management of septic systems; and
- proper management of de-icing chemicals and snow.

The long-term pollution prevention plan shall provide that sand piles be contained and stabilized to prevent the discharge of sand to wetlands or water bodies, and, where feasible, covered. If a Total Maximum Daily Load (TMDL) has been developed that indicates that the use of fertilizers containing nutrients must be reduced, the long-term pollution prevention plan shall also include nutrient management.

Post Development Controls

Once construction is completed, the post development stormwater controls for the following items are to be operated and maintained in compliance with the procedures set in this report (note that the continued implementation of these procedures shall be the responsibility of the Owner or its assignee):

1. Catch Basins, Manholes and Piping;
2. Proprietary Water Quality Treatment Devices;
3. Outlet Control Structures;
4. Stormwater Detention Basin.

Refer to the 30% Drawings to see the location of all stormwater BMPs. All BMPs have been placed in locations with sufficient maintenance access that will be responsibility of the Owner.

BMP ID: Catch Basins, Manholes and Piping.

Inspection Schedule:

- *At least annually.*

Inspection Description:

- *Open covers or inlet grates as applicable. Identify if there is any damage to the structure or connections to pipes or obstruction to flow and verify that a clear flow path exists. Check concrete encasement and adjacent paving for apparent structural soundness, damage, and signs of settlement. Inspect for evidence of pollutants.*

- *Note type of debris. Note existing water, debris and silt levels relative to a fixed point (such as the floor of the structure).*

- *Repair any damaged structures or pipe connections or obstructions to flow (such as silt and debris). Accumulated sediment and hydrocarbons present must be removed and properly disposed of off-site in accordance with local, state, federal, and other applicable requirements. Remove any silt or debris as required, but at least when sediment reaches within 6-inches of the inlet or outlet pipes.*

Public Safety Features:
Site is fenced off and will not be accessible to the public.

Operation and Maintenace Budget:
At this stage of the project, specific details regarding the party or parties responsible for operation and maintenance, as well as the estimated operation and maintenance budget and funding sources, are not yet available. This project is currently in the permitting phase, and ownership and operational responsibilities will be determined at a later date. However, we have provided rough magnitude costs based on data from the Rhode Island Stormwater Design and Installation Standards Manual (2011):

- *$1/gal to dewater and remove sludge*
- *$66/ton sediment dump fee*
- *$800/trip-day transport underground dredge materials*

STORM WATER MANAGEMENT SYSTEM OPERATIONS AND MAINTENANCE PLAN

CATCH BASINS, MANHOLES AND PIPING

Name of Inspector: _____ Title of Inspector: _____

Inspector's Signature: _____

Inspection Date	Satisfactory			Location	Maintenance Needed and Description	Implementation Date of Maintenance
	Yes	No	N/A			

BMP ID: Proprietary Water Quality Treatment Device

Inspection Schedule:

- *Quarterly inspection is recommended for the first year after installation. The frequency of inspections after the first year can be determined by observing the in the system. At minimum, every 6 months to meet certification requirements.*

- *Additionally, the device must be cleaned out when either pollutant removal capacity is reduced by 50% or more, or when 50% or more of the pollutant storage capacity is filled or displaced.*

Inspection Description:

- *Note the depth of sediment in the sump, 12 inches or greater will require maintenance to remove and dispose of in an environmentally friendly manner. If there is trash, debris, or oil, it should be removed as well.*

- *In dry weather conditions, there should be no standing water on the deck, if there is standing water in the backwash pool, this indicates that the filter cartridges must be rinsed.*

- *In wet weather conditions, observe the rate and movement of water in the unit. Note the depth of water above deck elevation within the maintenance access wall or inlet bay. Observe the amount of standing water on the deck. There should not be any beyond the backwash pool.*

- *Any appreciated sediment on the deck should be removed.*

- *If necessary, remove and rinse the individual cartridges to extend the life of the filter. If a cartridge is deemed unusable, replace it. Any missing pieces on the deck or the rest of the system should be replaced as well.*

Maintenance Schedule:

- *Varies based on the results of the inspection. If the filter is well maintained by the owner, cartridges should last 3-5 years.*

Public Safety Features:
Site is fenced off and will not be accessible to the public.

Operation and Maintenace Budget:
At this stage of the project, specific details regarding the party or parties responsible for operation and maintenance, as well as the estimated operation and maintenance budget and funding sources, are not yet available. This project is currently in the permitting phase, and ownership and operational responsibilities will be determined at a later date. However, we have provided rough magnitude costs based on data from the Rhode Island Stormwater Design and Installation Standards Manual (2011):

- *$1 per gallon of water to dewater and remove sludge*
- *$66 per ton sediment dump fee*

- *$800 per trip per day to transport underground dredge materials (minimum 2-4 trips per day for estimation)*

According to the supplier, it is estimated that it would cost $6.600 to replace all cartridges in the filter.

Additional Notes:
Inspection is required immediately after an upstream oil, fuel, or other chemical spill.

STORM WATER MANAGEMENT SYSTEM OPERATIONS AND MAINTENANCE PLAN

PROPRIETARY TREATMENT DEVICE

Name of Inspector: _____ Title of Inspector: _____

Inspector's Signature: _____

Inspection Date	Satisfactory			Location	Maintenance Needed and Description	Implementation Date of Maintenance
	Yes	No	N/A			

BMP ID: Outlet Control Structures

Inspection Schedule:

- *At least annually.*

Inspection Description:

- *Condition of rip-rap area should be cleared of all sediment deposits and invasive plant species.*
- *Inspect for damage (e.g. erosion, cracks, spalling, seepage/ weeps, failure, animal burrows). Damage and deterioration of the area shall be repaired immediately.*
- *Note any overgrown/ dead vegetation preventing or impeding access by maintenance personnel or equipment.*

Public Safety Features:
Site is fenced off and will not be accessible to the public.

Operation and Maintenace Budget:
At this stage of the project, specific details regarding the party or parties responsible for operation and maintenance, as well as the estimated operation and maintenance budget and funding sources, are not yet available. This project is currently in the permitting phase, and ownership and operational responsibilities will be determined at a later date.

STORM WATER MANAGEMENT SYSTEM OPERATIONS AND MAINTENANCE PLAN

OUTLET CONTROL STRUCTURES

Name of Inspector: _____ Title of Inspector: _____

Inspector's Signature: _____

Inspection Date	Satisfactory			Location	Maintenance Needed and Description	Implementation Date of Maintenance
	Yes	No	N/A			

BMP ID: Stormwater Detention Basin

Inspection Schedule:
At least annually.

Inspection Description:

Note any apparent high-water marks such as a debris line or discolored vegetation relative to a fixed point.

Note level of silt, sand or debris in bottom of basins relative to a fixed point.

Note type of debris. Inspect for evidence of pollutants.

Remove sediment from the forebay and basin as necessary. Wait until floor of the basin is thoroughly dry before removing sediment. At a minimum remove sediment accumulation immediately after construction and every five years after that.

Remove trash and debris and dispose of in an environmentally acceptable manner.

Remove excess vegetation from basin. Revegetate as needed.

Maintenance Schedule:
Twice a year: mow the buffer area, side slopes, and basin bottom. Remove trash and debris, grass clippings and accumulated organic matter.

Additional Notes:
If standing water is observed for longer than 72 hours after a storm event, a pump should be placed in the basin and discharged to the downstream manhole. After the system is dewatered it should be observed by a Professional Engineer, who should provide an opinion as to why the basin is not draining and provide recommendations to restore storage capacity to the system.

STORM WATER MANAGEMENT SYSTEM OPERATIONS AND MAINTENANCE PLAN

STORMWATER DETENTION BASIN

Name of Inspector: _____ Title of Inspector: _____

Inspector's Signature: _____

Inspection Date	Satisfactory			Location	Maintenance Needed and Description	Implementation Date of Maintenance
	Yes	No	N/A			

CASCADE separator®

The Cascade Separator®

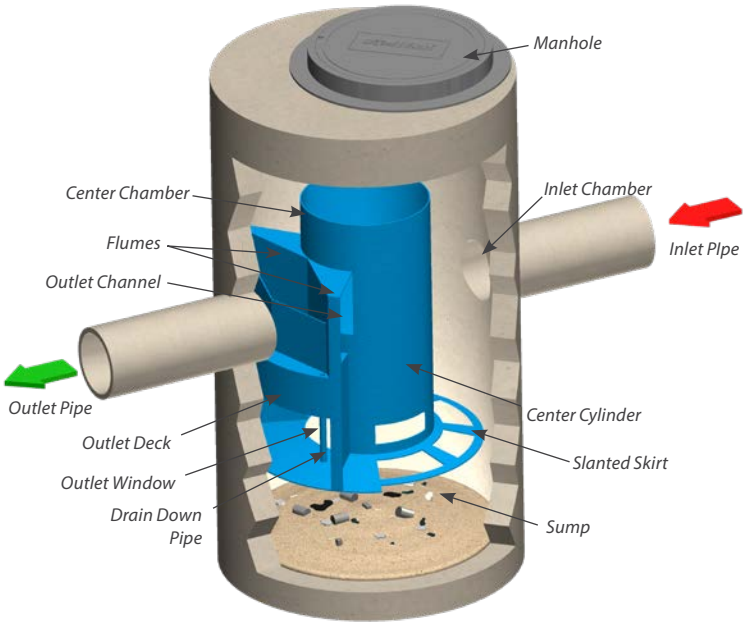
Advanced Sediment Capture Technology

The **Cascade Separator®** is the newest innovation in stormwater treatment from Contech. The Cascade Separator was developed by Contech's stormwater experts using advanced modeling tools and Contech's industry leading stormwater laboratory.

This innovative hydrodynamic separator excels at sediment capture and retention while also removing hydrocarbons, trash, and debris from stormwater runoff. What makes the Cascade Separator unique is the use of opposing vortices that enhance particle settling and a unique skirt design that allows for sediment transport into the sump while reducing turbulence and resuspension of previously captured material. These two factors allow the Cascade Separator to treat high flow rates in a small footprint, resulting in an efficient and economical solution for any site.

Learn More:
www.ContechES.com/cascade

FEATURE	BENEFIT
Unique skirt design & opposing vortices	Superior TSS removal; reduced system size and costs
Inlet area accepts wide range of inlet pipe angles	Design and installation flexibility
Accepts multiple inlet pipes	Eliminates the need for separate junction structure
Grate inlet option	Eliminates the need for a separate grate inlet structure
Internal bypass	Eliminates the need for a separate bypass structure
Clear access to sump and stored pollutants	Fast, easy maintenance

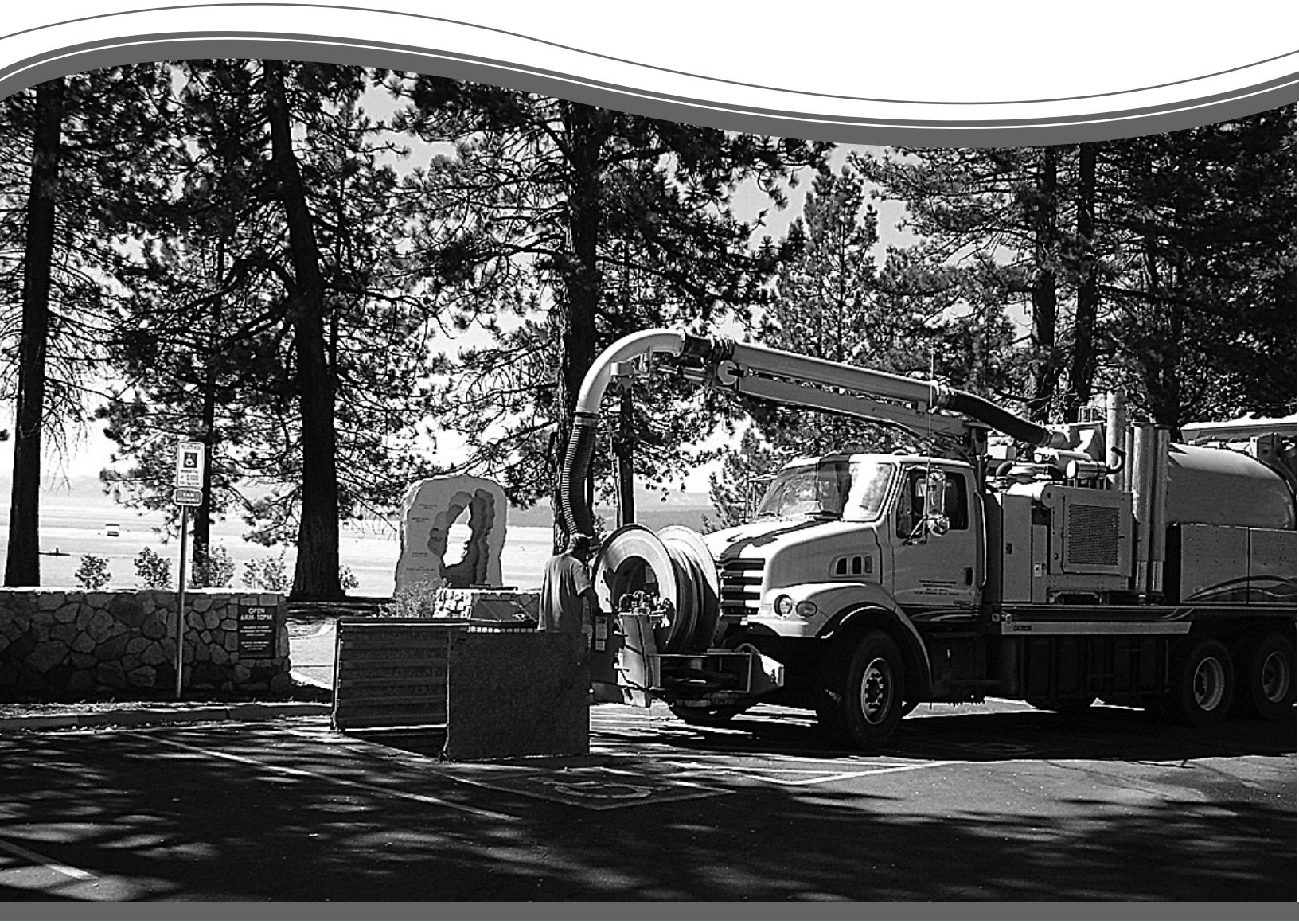


CASCADE MAINTENANCE

Cascade provides unobstructed access to stored pollutants, making it easy to maintain using a vacuum truck, with no requirement to enter the unit.

CONTECH®
ENGINEERED SOLUTIONS

Cascade Separator® Inspection and Maintenance Guide



CASCADE
separator®

Maintenance

The Cascade Separator® system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects sediment and debris will depend upon on-site activities and site pollutant characteristics. For example, unstable soils or heavy winter sanding will cause the sediment storage sump to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (i.e. spring and fall). However, more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment wash-down areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

A visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet chamber, flumes or outlet channel. The inspection should also quantify the accumulation of hydrocarbons, trash and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided in this Inspection and Maintenance Guide.

Access to the Cascade Separator unit is typically achieved through one manhole access cover. The opening allows for inspection and cleanout of the center chamber (cylinder) and sediment storage sump, as well as inspection of the inlet chamber and slanted skirt. For large units, multiple manhole covers allow access to the chambers and sump.

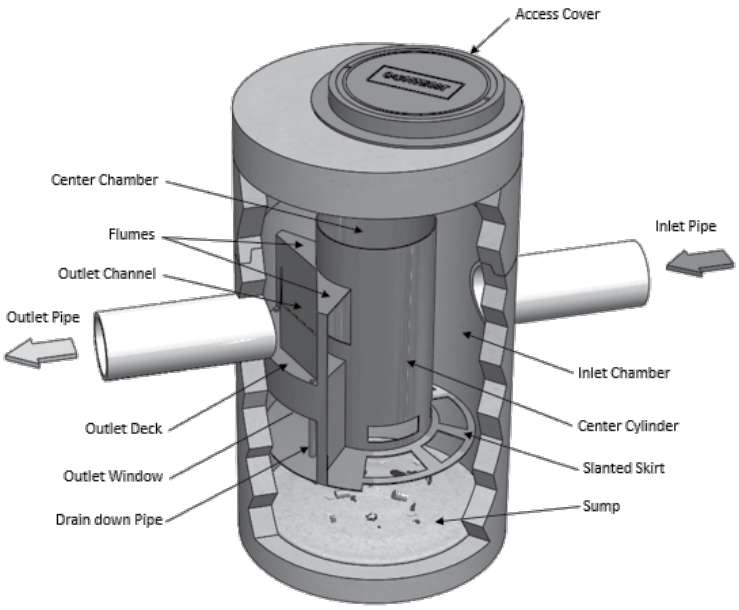
The Cascade Separator system should be cleaned before the level of sediment in the sump reaches the maximum sediment depth and/or when an appreciable level of hydrocarbons and trash has accumulated. If sorbent material is used, it must be replaced when significant discoloration has occurred. Performance may be impacted when maximum sediment storage capacity is exceeded. Contech recommends maintaining the system when sediment level reaches 50% of maximum storage volume. The level of sediment is easily determined by measuring the distance from the system outlet invert (standing water level) to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Finer, silty particles at the top of the pile typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the chart in this document to determine if the height of the sediment pile off the bottom of the sump floor exceeds 50% of the maximum sediment storage.

Cleaning

Cleaning of a Cascade Separator system should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole cover and insert the vacuum tube down through the center chamber and into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The areas outside the center chamber and the slanted skirt should also be washed off if pollutant build-up exists in these areas.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. Then the system should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and to ensure proper safety precautions. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the Cascade Separator system must be done in accordance with local regulations. In many locations, disposal of evacuated sediments may be handled in the same manner as disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal. If any components are damaged, replacement parts can be ordered from the manufacturer.



Cascade Separator® Maintenance Indicators and Sediment Storage Capacities

Model Number	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y^3	m^3
CS-3	3	0.9	1.5	0.5	0.4	0.3
CS-4	4	1.2	2.5	0.8	0.7	0.5
CS-5	5	1.3	3	0.9	1.1	0.8
CS-6	6	1.8	3.5	1	1.6	1.2
CS-8	8	2.4	4.8	1.4	2.8	2.1
CS-10	10	3.0	6.2	1.9	4.4	3.3
CS-12	12	3.6	7.5	2.3	6.3	4.8

Note: The information in the chart is for standard units. Units may have been designed with non-standard sediment storage depth.

A Cascade Separator unit can be easily cleaned in less than 30 minutes.

A vacuum truck excavates pollutants from the systems.

Cascade Separator® Inspection & Maintenance Log

Cascade Model:			Location:		
Date	Depth Below Invert to Top of Sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The depth to sediment is determined by taking a measurement from the manhole outlet invert (standing water level) to the top of the sediment pile. Once this measurement is recorded, it should be compared to the chart in the maintenance guide to determine if the height of the sediment pile off the bottom of the sump floor exceeds 50% of the maximum sediment storage. Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.
2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

SUPPORT

- Drawings and specifications are available at www.ContechES.com.
- Site-specific design support is available from our engineers.

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, and earth stabilization products. For information, visit www.ContechES.com or call 800.338.1122

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